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MEMORANDUM.

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IMPORTANT IMPROVEMENTS IN THE ART OF WAR DURING THE PAST TWENTY YEARS AND THEIR PROBABLE EFFECT ON FUTURE MILITARY OPERATIONS.

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PART I.

IMPORTANT IMPROVEMENTS IN THE ART OF WAR DURING THE PAST TWENTY YEARS.

To follow, step by step, the growth of progress in the means of war during the past twenty years, would not be possible within the limits of this paper; neither could this serve the purpose of the inquiry, which relates more to the designation and the limits of improvements and to aggregate advancement, than to their history. The military spirit, though occasionally antagonistic to rapid evolution in civilization, has not unfrequently been a large factor of the most progressive ideas. And at all times, not only has the conduct of war been in harmony with the development of the period, but the appliances of war have literally represented the relative state of material progress of the age.

The present, as the machine age of the industrial arts, reflects more than any other the machine age of warfare; its characteristics being the application of mechanical arts to the offensive and defensive energies of nations at war.

Though the latter half of the 19th century has shown itself most prolific in this respect, doubtless improvements

will be presented before its close, quite as fertile in new conditions imposed upon warfare, as have been those already developed. The prominent improvements in artillery during the past twenty years, relate to the range, accuracy of fire, and penetrative power of this arm. On the appearance of rifled small arms a quarter of a century since, it was proclaimed that the days of artillery were numbered; and

TABLE "A."

TABLE OF AMERICAN ORDNANCE, 1861.

Guns	Field	3-in. (rifled)	Wrought Iron or Steel.
		6-pounder	Bronze.
		12 "	
		12 "	
	Siege and Garrison	4, 5-in. (rifled)	Cast Iron.
		12 pounder	
		18 "	
		24 "	
	Sea Coast	32 "	
		42 "	
Columbiads		8-inch	Cast Iron.
		8 "	
		10 "	
		10 "	
		15 "	
Howitzers	Mountain	12-pounder	
	Field	12 "	Bronze.
		24 "	
		32 "	
	Garrison and Siege	24 "	Cast Iron.
		8-inch	
	Sea Coast	8 "	
		10 "	
Mortars	Siege	8 "	Cast Iron.
		8 "	
		10 "	
		10 "	
	Sea-coast	10 "	
		10 "	
		13 "	
		13 "	
	Coehorn	24-pounder	Bronze.

as the killing power of the new, over the old arm, had been increased from 350 to 1,400 yards, it did not require demonstration to convince that unless the effective fire of artillery could be correspondingly increased over that of smooth-bore guns, it must be consigned to a subordinate place. But the advent of rifled guns followed closely, and partially restored the importance of artillery. As will be seen from

table "A," in 1861, the ordnance of the United States, with the exception of one siege and one field gun was of the smooth-bore character. It was in no respect inferior to foreign ordnance; it was in some features superior, inasmuch as the heaviest columbiads were of larger calibre than most European ordnance, and combined the qualities of the gun, the howitzer, and mortar, being equally suited to the defence of narrow channels and distant road-steads. We were then rapidly setting aside the 24, 32, and 42 pounder guns for columbiads, firing either shot or shell, at as high as 30° elevation, and giving ranges from 3,800 to 4,700 yards.

In the spring of 1860, the first Rodman gun (15 inch) was perfected. It was loaded with facility, and gave greater precision of fire than the columbiads; and an extreme range of 5,400 yards with a windage of only one-tenth of an inch. Captain Rodman's method of cooling cannon from the interior, contributed to the endurance of the piece, produced a more homogeneous casting, and resulted in cast-iron cannon not only stronger, but less liable to enlargement of the bore. From that time the smooth-bore ordnance of America was, in power, endurance and working capacity, equal to any in the world.

Improvements by Americans in the method of working cast-iron, were important advances in gun making, and permitted an increase in the calibre of cast-iron sea-coast cannon.

From 1861 to 1874 there were adopted six different calibres of heavy smooth-bore guns of from 8 to 20 inches, the last having an extreme range of 8,000 yards. These guns sustain heavy charges of powder, and give initial velocities of 1,500 feet; and with an accuracy at 1,500 yards, equal to the best rifle guns.

AMERICAN HEAVY RIFLED GUNS.

It was during the pressing emergencies of our great civil struggle, and at a period of comparative anarchy of ideas in

heavy rifled gun making, that there were hurried into service rifled guns of large calibre of the Parrott system :—cast-iron guns hooped with wrought-iron, Parrott's patent for his rifled gun was dated October 1st, 1861, and in 1862, on the appearance of his 8-inch 200 pounder, it was pronounced, by competent English authority, the most powerful gun in existence.

Forty-four heavy Parrott guns burst during the siege of Charleston and six at Fort Fisher; results which might have been anticipated, considering the different expansive powers of wrought and cast-iron used in their construction, and they have naturally been since regarded as unsafe. Notwithstanding these disadvantages however, the guns of the Parrott system were a great advance over the smooth-bore in range and precision. Though the prodigious crushing effect of the large projectiles of the latter, and their power and precision for short distances, have kept them in service, they have the deficiencies of all smooth-bore guns. In 1870 our ordnance bureau began the manufacture of muzzle-loading cast-iron rifled guns: the augmentation of defensive strength of armor, and the increased power of foreign ordnance, rendering necessary corresponding changes in our own. Objections to the use of cast-iron for heavy rifled guns, and the greater strength of wrought-iron, led in 1874 to the adoption of a method of converting the Rodman guns into rifles, by lining them with a coiled wrought-iron tube, having a jacket shrunk on extending through the breech.

The old difficulty of imperfect welding developed grave accidents in the muzzle insertions of these tubes, by their being blown out, and tearing off the muzzles of the guns.

To prevent this the breech insertion was adopted, and a shoulder provided in the tube, in front of the charge. But it is by no means yet determined, that cast-iron guns so lined are improvements on rifled guns constructed wholly of cast-iron; it being claimed that while the bore is reduced,

TABLE "B."

TABLES OF COMPARATIVE POWER OF AMERICAN AND EUROPEAN HEAVY RIFLED ORDNANCE.

I.—12-INCH RIFLES OF 1880.

KIND OF GUN.	Calibre.	Weight of Guns.	Length of Bore.	Charge of Powder.	Weight of Shot.	Muzzle Velocity.	Energy per inch of Shots. Circumference at 4,000 yds.	Range.
	Inches	Tons.	Inches.	Pounds	Pounds	Feet.	Ft. Tons.	
Armstrong breech-loader	12	38.89	264	179.6	697.5	1,614		
English muzzle-loader, (wrought iron, steel tube	12	35	162.5	110	700	1,300	124.9	
Krupp breech-loader (steel)	12	35.30	227.167	110	664	1,329	113.6	
Italian breech-loader (cast-iron, steel hooped)	12.6	37	252	110	770	1,220	113.4	
American muzzle-loader (cast-iron, wrought iron tube)	12.25	40	227	110	700	1,403	127.7	

II.—11-INCH RIFLES.

English muzzle-loader (wrought iron, steel tube)	11	25	145	85	535	1,315	96.	
Krupp breech-loader (steel,	11	27	207	88	495	1,410	93.7	
French breech-loader (cast-iron, steel hooped and tubed)	10.803	21.7	163.7	79.38	476.4	1,378	88.7	2° 1197 yds.
American muzzle-loader (cast-iron, wrought-iron tube)	11	33.7	161	85	535	1,359	100.7	14° 6038 yds.

III.—10-INCH RIFLES.

English muzzle-loader (wrought-iron, steel tube)	10	18	145.5	70	400	1,364	78.4	
Krupp breech-loader (steel)	10	19.44	169.6	66	374	1,426	74.6	
Italian breech-loader (cast-iron, steel hooped)	9.448	17	157.5	66	330	1,426.8	69.2	
French breech-loader (cast-iron, steel hooped and tubed)	9.449	13.8	162.55	61.74	317.6	1,427	64	
American muzzle-loader (cast-iron, wrought-iron tube)	10	18	147.22	70	400	1,381	79.7	

IV.—8-INCH RIFLES.

English muzzle-loader (wrought-iron, steel tube)	8	9	118	35	180	1,413	36	
Krupp breech-loader (steel)	8.26	9.7	161.8	37.4	216	1,384	44.7	
French breech-loader (cast-iron, steel hooped and tubed)	7.638	7.9	135.39	33.1	165.4	1,486	37.1	2° 1125 yds.
American muzzle-loader (cast-iron, wrought-iron tube)	8	7.66	117.25	35	180	1,414	36	27½° 9419 yds.

little strength is added to the cast-iron structure, by lining with a softer material.

In the use of these guns there has been more or less opening of the welds; the tubes have in some cases

cracked completely through; and the heavy steel jacket has been ruptured; the gun body in many instances remaining uninjured. While it is not denied that the wrought-iron tube is stronger than the cast-iron, it is held that its form is more rapidly changed under the strain of discharge; and that good American gun iron with a high elastic limit, either cast, or wrought, homogeneously re-inforced, is equal to even cast-iron hooped with steel. It certainly would appear that any combination of metals, differing in physical properties and characteristics, as do cast and wrought-iron, could not result in a gain, in the ratio of their tensile and transverse strength: and in England experiments in this direction have long since been abandoned. But it is certain that the subject is far better understood by the light of experience, than ten years ago; and it is equally certain, that in their shooting qualities, these guns compare quite favorably in power, at least, with European guns, as will be seen by reference to the table "B."

AMERICAN LIGHT RIFLED GUNS.

While we have been careful observers of the steady progress of Europeans in field armament, we have not had the same cause for anxiety, since our dangers from foreign foes have lain near our sea-coast; and it has been chiefly for the benefit of that line, that our meagre appropriations have been expended. With the exception of the thirty-pounder Parrott, now below the standard of efficiency, with strength, we have but one rifled siege gun,—4½-inch cast-iron adopted in 1861. Of field guns, there are a 3½-inch and a 3-inch rifle of wrought-iron of moderate merits; and a gun recently produced, a breech-loading rifle of 3.18 inches calibre which, in construction and power, is regarded as but little inferior to the best foreign field guns.

European Artillery.—As has been stated, in 1861 American smooth-bore, heavy and light ordnance, was inferior to none, so that we shall pass on; to the heavy rifled guns of Europe. The first rifled ordnance used in warfare

were the 68 pounder and 8-inch Lancaster guns of the English at the siege of Sebastopol in 1854. But for abundant reasons they were soon dropped from service, and no other rifled guns was used in England until Armstrong's 12 pounder field gun was adopted in 1860, But a considerable advance had been made in rifled guns of large calibre in Europe as early as 1860.

The heavy Blakely gun of cast-iron with a wrought-iron jacket was officially experimented upon as early as 1855: and was subsequently twice unfavorably reported upon in 1859 and 1863, but never adopted. On the continent, the direction of invention, and of most progress was toward breech-loaders; those of Wahrendorf and Cavalli being the most noted prior to 1860; though they were each, in many particulars, very objectionable: the breech-loading mechanism being complicated, the breech imperfectly closed, and wanting in solidity and in safety. Various plans of rifling, and systems of breech-loading, were continually brought forward; some identical with, and some modifications of those of more ancient date, but none prior to 1860 were officially adopted in any country.

In that year the French rifled their cast-iron 30 and 50 pounders, to throw shells of 60 and 89 pounds. These guns had three grooves of increasing twist, and were strengthened by wrought-iron hoops. The projectiles had three large studs, one-half of zinc and one-half cast on the shell. The guns were very deficient in accuracy. A great impetus was given to the subject of rifled guns of all calibres by the effective work of the French guns in the Italian campaign. This was the first occasion of the employment of rifled field artillery. Spain and Austria at once followed the system of rifling of Colonel de Beaulieu's or the French plan; as also did Italy for both her light and heavy guns. Russia was at first more tardy in action, but in the end more hurried, adopting a method of rifling of their own, and then abandoning it for that of Krupp. In England, the

first rifled gun adopted was Armstrong's light 12 pounder in 1860; and though it was by no means the first built up gun, it was the official beginning of that celebrated system soon afterwards adopted for all English ordnance. He immediately assigned to the crown the rights of his invention and simultaneously became one to organize the Elswick Ordnance Company: and there, and at Woolwich, have since been made these guns; those of Woolwich being muzzle-loaders, and having soft metal studs, or ribs on the projectile, much like those of the French; and those of Elswick being breech-loaders, the projectiles at first, having soft metal coatings, larger in diameter than the bore of the gun and representing the compressing system of rifling.

The Prussians adopted the breech-loading and the compression plan soon after the Armstrong gun appeared in England; and as these two guns have given better results than any others, they illustrate the extreme advances in artillery.

In England, cast-iron, whether singly, or in combination with wrought-iron found but little favor, and attention was early directed to wrought-iron in solid form which was considered safer. But in practice the various methods of forging failed to produce uniform density, the great difficulty being to form a perfect weld between the parts; and the method of manufacture was highly injurious to the strength of the iron.

Solid iron, in any form, being in the estimation of the English and Prussians unsafe as a material, there was no alternative but to build up guns by welding hoops, or jackets of homogeneous metal, around inner tubes of steel, And the degree of excellence to which the latter metal has been brought, both in England and in Prussia, has enabled those two countries by lavish expenditures, to produce built up rifled guns of the highest perfection.

The most reliable professional authorities in this country and Europe, pronounce the Prussian guns of Krupp's

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Table showing the weights, dimensions, charges, etc., of the most powerfu

NATURE OF GUN.	Calibre.	Weight.	Total length.	Length of bore.		Number of grooves.	Weight of powder charge.	Weig
	Inches.	Tons.	Feet.	Feet.	Calibres.		Lbs.	Lbs
ENGLISH.								
WOOLWICH.								
M. L. Cannon of coiled wrought iron, lined with tube of cast steel. Frazier's system...	16	80	36.9	24	18	11	425	1,7
ELSWICK.								
M. L. Cannon of coiled wrought iron, lined with tube of cast steel. Armstrong's system.	17.72	100	32.9	30.25	20	38	463	2,0
CERMAN.								
ESSEN.								
B. L. cannon, steel-hooped. Krupp's system.	15.75	.71	32.8	28.57	21.77	00	484	1,7
	12	38	25.09	22	22	68	158.4	7
	19.45	17.67	33.41	17.75	22.5	54	176.4	3
ITALIAN.								
TURIN.								
B. L. cannon of cast iron, hooped with steel. General Rosset's system.....	18.1	87	29.52	27.5	18.25	60	440	2,2
FRENCH.								
RUELLE.								
B. L. cannon, steel hooped.....	18.11	124	33.59	31.09	20.6	..	573	2,6
RUSSIAN.								
B. L. cannon, cast steel, hooped.....	12	39	20	17	17	30	114	6
UNITED STATES.								
M. L. cannon, cast iron, lined with coiled wrough iron tube.....	12.25	40	21.81	18.74	18.55	7	115	7
B. L. cannon (proposed model) lined with steel and coiled wrought iron.....	12	55	28.3	25	25	..	290	8

COMPARED WITH THE

The 300-pounder Parrott gun was regarded by English authorities, on its appearance in 1862, as
This gun, with 25 lbs. powder and a 70 lbs. spherical shot, gave a muzzle velocity of 1,800 feet. Calib
125 to 175 lbs.; muzzle velocity, 1,809 feet at 11° 47'. Elevation gave 4,272 yards range.

TABLE "C."

most powerful service and experimental guns existing or proposed at the commencement of 1880.

Number of grooves.	Weight of powder charge.	Projectile. Weight.	Projectile. Means of rotation.	Initial velocity.	Pressure per square inch of bore.	Total muzzle energy	(Calculated) Penetration in iron at 1,000 yds.	REMARKS.
	Lbs.	Lbs.		Feet.	Tons.	Ft. Tons.	Inches.	
11	425	1,760	Bronze studs and expanding gas checks.	1,584	21	30,612	28.08	
28	463	2,010	Expanding gas check....	1,640	21	37,476	25.88	* The 71-ton gun is the largest yet made by Krupp—gives higher velocities than the Woolwich 80-ton gun or Elswick 100-ton. Against armor is as effective as the latter, and more so than the former. It will pierce 24 inches iron plating at 5,400 yards.
90	484	1,711	Copper bands.....	1,702	20.9	34.359	31.81	
68	158.4	731	Copper bands.....	1,649	.....	13,817	21.09	
54	176.4	308	Copper bands.....	2,086	19.49	9,291	19.49	† Projectile of the 9-inch or 24 centimeter drove a shell through 20 inches of iron plating, and it travelled 3,250 feet afterwards. This gun is about equal in power to the English 38-ton gun, though not half its weight. Of five rounds fired with chilled shell at a target 2.734 yards distant, one missed and four hit within a parallelogram 3 feet 6 inches wide and 9 feet 6 inches high.
60	440	2,300	.....	1,378	Probably about 14 tons.	28,959	20.87	
..	573	2,645	Copper bands.....	1,640	.....	49,316	35.73	
36	114	650	Lead coating.....	1,400	.....	8,764	13.59	
7	115	700	Expanding gas check....	1,485	15	10,701	15.75	
..	290	800	Expanding gas check....	1,880	.....	19,726	29.83	

RANGE OF AMERICAN BREECH-LOADER.

Elevation.				
2°	8°	16°	25°	34°
Yards.	Yards.	Yards.	Yards.	Yards.
2,165	6,706	10,328	13,273	14,938

CD WITH THE BEST HEAVY GUN OF 1862.

ance in 1862, as the most powerful service gun extant, and it is properly taken to contrast with the best heavy guns of 1880
00 feet. Calibre, 8 inches; weight, 8 1-7 tons; length of bore, 136 inches; charge of powder, 16 lbs.; weight of projectile,

manufacture both heavy and light, the best in the world. And English artillerists place the merits of Krupp's guns higher than their own.

The 40-centimetre or 16½-inch, 71 ton gun, is the largest yet manfactured in Krupp's establishment. It gives higher velocities than either the Woolwich 80 ton, or the Armstrong 100 ton gun; and against armor, is as effective as the latter and more so than the former, it being capable of piercing iron plates 24 inches thick at 5,400 yards. The Krupp 24-centimetre or 9-inch gun, firing a chilled steel shell of 352 pounds, gives an initial velocity of 1,910 feet per second, and a total energy of 8,755 foot-tons. This gun weighs 18 tons and the English 38 ton gun exerts about the same power. "It would not be unfair to say, that of heavy guns those of Krupp are about equal in power and penetration to Woolwich guns of twice their weight."

The Krupp guns are all of the same general type. They are all of steel, and all are rifled by a large number of shallow grooves separated by narrow lands. "The ground work is recognized that power is gained by a low maximum long maintained pressure; and that this pressure is best supported by employing an inner tube of steel strengthened by an exterior of steel shrunk on in coils." The steel is near perfection in fabrication, and this, with the thorough construction of the gun, constitutes an important factor of its ascendency.

The points of superiority are, the greater suppression of windage; the certainty of the projectile receiving the rifling motion: careful adaptation of the inclination of the grooves to the calibre, form of projectile, and charge of powder; great perfection of projectile in uniformity of dimensions, figure, density and mass; suppression of gas escape at the fermature; greater stability of flight of the projectile; greater initial velocity, range and accuracy. "The principles successfully established are the use of steel as a material; the method of rifling with large

bearing surfaces and shallow grooves; and the use of increased powder chambers, and barrels of sufficient length and diameter to burn the charge." Krupp has thus produced guns of greater general accuracy and higher power than any others, relative to weight of metal.

The positive advance then in heavy guns, during the past twenty years is from the imperfect 200 pounder Parrott gun to the perfect Krupp breech-loader, penetrating over three feet of iron and weighing only 38 tons.

Field guns of Europe.—In 1861, American *smooth-bore* light guns, were fair representatives of those of Europe, and as there has been no advance in the power of either, we shall proceed to consider the changes in rifled field guns.

As has been stated, they were first used by the French in the war of 1859 and contributed largely to their success at the battle of Solferino. They were brass guns of six hundred weight, throwing a projectile of nine pounds. They fired the ordinary shot, as well as the elongated projectile, and case shot at close quarters. The rifling consisted of six rounded grooves, and the projectiles had twelve zinc studs arranged in pairs. As early as 1861 Spain, Austria and Italy, had adopted the French system of rifle and projectiles. England the Armstrong in 1860; and Prussia began to use the breech-loading and compression plan of rifling, soon after. The rifled field guns first in use, though in range and accuracy greatly superior to the old guns, were still very inaccurate, and their destructive effect was by no means in the ratio of their increased range.

At high velocities, grape and case shot could not be fired so that within ranges of 600 or 700 yards, the advantage remained with the old weapons. These facts are recognized at home and in Europe, and we consequently find nations retaining some smooth-bores. As the chief merit of early rifled guns was, increased range and accuracy, it was most important to invest them at these greater distances, with the formidable character of the smooth-bore, at shorter range.

The first step in this direction was the introduction of the Armstrong segment shell, which breaking up into a greater number of fragments than the common shell, proved much superior; but as it had certain defects of flight, and but imperfectly answered the necessary requirements, the shrapnel shell was adapted to rifled guns. Another step was the substitution of steel tubes, hooped with iron, or steel, for bronze guns. This was imperative: for to make shrapnel vigorously destructive, guns were wanted imparting a much higher initial velocity giving a greater range and consequent flatter trajectory; and to sustain the greater strain, it was necessary that the steel should succeed the bronze guns.

TABLE "D."

COMPARATIVE RANGES OF SMOOTH-BORE AND EARLY RIFLED FIELD GUNS.

	Smooth-bore, American 6-pounder, Field Gun.		Smooth-bore, American 12-pounder, Field Gun.		American 3-inch M. L. Rifle.	English 12-pounder, 3-inch, B. L.	3.6-inch Prussian 6-pounder, B. L.	3.6-inch Austrian 8-pounder, M. L.
Weight of charge	1.25 lbs.		2.5 lbs.		1 lb.	1.6 lbs.	1.4 lbs	2 lbs.
Weight of projectile	solid shot	spherical case.	solid shot	spherical case.	shell, weight 11 lbs.	shell.	shell.	shell.
Elevation	5°	4°	5°	3.45°	12°	12°	12°	12°
Range in yards	1,523	1,200	1,680	1,135	3,270	4,150	3,304	3,075
	10°-range, 1,800 yards.		12°-range, 2,000 yards.		20°-range, 3,972 yards.	20°-range, 5,325 yards.		

But the rapid advances made in breech-loading small arms, in range and precision, again forced the issue between infantry and artillery fire, and nations were again quickened to the importance of still greater power in field guns. Prussia was the first to lead in supplying guns firing larger

shells, with heavier charges and giving higher velocities. One heavier gun, in place of a variety in calibre of light guns, was adopted; and the common shell improved to give from 120 to 150 fragments. And these changes with the same general result, have been adopted in Europe.

The best type of this gun is the Krupp 9.6-centimetre—3¾ inches calibre; length, 7 feet;—weight 1,200 pounds;—powder chamber 13.3 inches long;—diameter, 4 inches;—initial velocity 1,481 feet;—energy, 405 tons; weight, of shell, common, or ring shell, 26 pounds;—powder charge, 5 pounds. "Ten rounds, fired at a horizontal target 8,748 yards distant, fell in two groups, one 60 yards in advance of the other; the nearer within a parallelogram 40 yards broad and 65 deep, and the farther of 60 yards broad and 30 deep."

In a new country where roads are unfrequent and inferior, the ordinary heavy field gun of European countries would not permit great mobility. To secure this, there has been recently constructed by Krupp, a light field gun, 7.5-centimetres, of superior accuracy at from 1,000 to 4,575 yards, to either the Austrian, English or Italian field guns of the same calibre but of greater weight of metal and parts, by from one-fourth to one-half. Everything considered it is unquestionably the best light field gun in the world. See table "F." The best systems of European field artillery are those of Prussia, Russia and Italy.

These guns are steel breech-loaders with breech jackets of steel. The French guns are steel breech-loaders strengthened at the breech by steel rings; while the Austrian are steel bronze breech-loaders. The English, though pioneers in breech-loading, adopted the muzzle-loader in its place in 1866, as they found the then breech-loading method of Armstrong, if not positively bad, too complicated and imperfect for field service. Contrasting the range, precision and destructive effect, of the best rifled field guns of twenty years ago, with the best of the more recently constructed, and it may be said in general terms that the range has been

TABLE "E."

Table of mean errors in range and direction of some of the best shooting, S. B. and rifled light guns of 1860 *and* 1880.

KIND OF ORDNANCE.	Calibre.	Weight.	Length of bore.	Powder service charge.	Weight of projectile.	Muzzle velocity.	Greatest range.	Range in yards.	Angle of elevation.	Mean deflection in feet.		Range in yards.	Angle of elevation.	Mean deflection in feet.	
FIELD GUNS.	inches.	lbs.	inches.	lbs.	lbs.	feet.	yards.	yards.	° ′	longi-tudinal.	lateral.	yards.	° ′	longi-tudinal.	lateral.
Rifled—1860. Armstrong B. L., 12-pounder.	3	866	78	1 lb. 6 oz.	12	923	3,600	1,130	2°	123	8.1	2,146	5°	111	11.7
Rifled—1881. French 8-c. m.—B. L.	3.15	940	89.76	3 lbs. 5 oz.	12.3	1,008	7,000	1,094	1°,32′	83 mean error in range	3. mean error in direction	2,188	3°,53′	84 mean error in range	5. mean error in direction
Smooth bore—1860. 18-pounder—English	5	3,800	96	6 lbs.	32	.....	2,600	1,000	1°,50′	130	12	2,000	6°	180	30

Of ten shots from Krupp's 4½-inch field gun, fired at a horizontal target 10,300 yards distant, all were included within 44, and nine within 18 yards of lateral deviation; and within 800 yards of distance, the extreme ranges being 9,700 and 10,500 yards. Of ten shots fired from the 3⅕-inch gun at a target 8,700 yards distant, five fell within a parallelogram 70 yards long and 40 wide, and the other five within a parallelogram 33 yards long and 65 yards wide, the extremes of range being 8,833 and 9,057 yards.

increased one-half; accuracy of fire threefold, and that the destructive effect is immensely greater.

The features of change, resulting in gain of power, in both light and heavy guns during the past twenty years are, in the strength of the material used; the method of manufacture; greater length of bore; suitably enlarged powder chambers; large increase of powder charges; suppression of windage and gas escape; and the allowance of air space in the chamber about the cartridge, permitting the use of larger charges without straining the gun.

Mortars and Howitzers.—In our own country modifications in mortars have been by a slight increase in length and weight of metal in the large calibres; and by forming elliptical chambers, permitting the projectile to rest always in contact with the powder. The result has been a small increase in range, that of the sea-coast being 4,500, and of the siege 1,200 to 2,200 yards. These ranges are not less than those of European smooth-bores, and but little inferior to those of European rifled mortars.

The gain by rifling in accuracy of fire, and in stability of flight of the projectile, in the latter has been conspicuously small. And it is a question whether the application of rifling and rifled projectiles to mortars is a gain commensurate with the outlay demanded. On the other hand the general adoption abroad of rifled howitzers has been fully warranted by improved ranges and precision of fire. It is unimportant to refer at length to the materials used and the method of fabrication, since they are essentially the same in the principal European countries, as those determined upon as the best for guns. The Krupp rifled 28-centimetre, (11 inch) howitzer, of 1879 gave with an elevation of 28½° a range of more than 8,000 yards. Ten shots from this piece fired at a supposed ship's deck 7,300 yards away, struck within a parallelogram 100 yards long, and 25 yards wide.

RIFLING.

In rifling, though certain elements are still undetermined,

the importance of the subject has brought it under constant experiment since the introduction of heavy rifled ordnance. The points sought have been range, accuracy of fire, endurance of gun, and facility in loading. The factors not ascertained, are, the most suitable inclination of grooves for any given projectile; the precise comparative advantages of uniform and variable grooves for projectiles of different dimensions, and the proper number of grooves. The general gain has been that difficulties not before considered, have been brought conspicuously to the front, of too many, or too few grooves; also the necessity of considering the form of the projectile and initial velocity; while the advantages and disadvantages of depth and number of grooves are better understood. The direct facts evolved are that there is a particular inclination of grooves, best suited to each calibre, form of projectile, initial velocity and angle of fire: and indirectly it appears, that the charge of powder and weight of projectile, should if possible, always be the same. In general terms experiments show that the best results are now derived from broad and shallow grooves with a moderate twist; and that increase of twist is necessary, to give steadiness of flight to increased length of projectile. The Krupp guns have numerous shallow grooves increasing in number with the calibre, closely set together, and about twice the width of the lands. They form a marked contrast to the deep grooves, few in number, and separated by lands wider than the grooves used in the English artillery.

PROJECTILES.

With smooth bore projectiles the most notable features of change are, the more extensive use and larger size of shells;—progress in construction of projectiles affecting mainly those for rifled guns.

The superiority of elongated projectiles rests in their precision: their high velocities sustained at long distances; their greater weight and the greater certainty of

TABLE "F."

Experimental Trials

Of a light 7.5-c.m. field gun, made by Fried. Krupp, at the practice-ground near Meppen, October and November, 1879.

Krupp's Light 7.5-c.m. Field Gun.

	Krupp's light 7.5-cm. field gun.	Austrian 7.5-cm. field gun.	English 9 pounder for horse artillery.	Italian 7.5-cm. gun.
Total length of gun	1,800 mm.	1,950 mm.	1,892 mm.	1,780 mm.
Length of line of sight	940 mm.	1,000 mm.	.....	.....
Diameter of bore, measuring from the lands	75 mm.	75 mm.	76.2 mm.	75 mm.
Diameter of bore, measuring in the grooves	77.5 mm.	77.5 mm.	.....	77.6 mm.
Number of grooves	24	24	3	12 mm.
Depth of grooves	1.25 mm.	1.25 mm.	.....	1.3 mm.
Breadth of lands	2.8 mm.	2.8 mm.	.....	3.6-7.1 mm.
Breadth of grooves	7 mm.	7 mm.	.....	16-12.5 mm.
Twist of rifling	32 calibres.	45 calibres	30 calibres.	47½ calibres.
Weight of gun, with breech piece	335 kg.	299 kg.	305 kg.	300 kg.
Preponderance	35 kg.	37 kg.	.....	18 kg.
Weight of shell	4.3 kg.	4.3 kg.	4.11 kg.	3.72 kg.
Weight of shrapnel shell	4.355 kg.	4.609 kg.	4.44 kg.	4.20 kg.
Weight of case shot	4.2 kg.	4.728 kg.	4.46 kg.	4.11 kg.
Powder charge	0.75 kg.	0.95 kg.	0.794 kg.	0.85 kg.
Velocity of shell at the muzzle	420 m.	422 m.	421 m.	400 m.
Weight of gun with breech piece	235 kg.	299 kg.	305 kg.	300 kg.
Weight of carriage without gun and accessories	260 kg.	464 kg.	551 kg.	367 kg.
Weight of carriage with gun and accessories	515 kg.	766 kg.	889 kg.	.....
Weight of limber without accessories	255 kg.	442 kg.	536 kg.	306 kg.
Weight of limber with ammunition and accessories	460 kg.	787 kg.	793 kg.	.....
Weight of gun with limber complete	975 kg.	1,553 kg.	1,682 kg.	1,247 kg.
Length from pole end to tail board	6,000 mm.	8,600 mm.	.....	6,700 mm.
Length from centre to centre of axles	2,200 mm.	2,955 mm.	.....	.....
Amount of track	1,250 mm.	1,530 mm.	1,511 mm.	1,360 mm.
Diameter of wheels	1,310 mm.	1,370 mm.	1,594 mm.	1,260 mm.
Weight of one wheel	43.5 kg.	68 kg.	104 kg.	55 kg.
Angle of lock	120 degrees.	90 degrees.	.....	.....
Number of horses	4	6	6	4
Draught-weight per horse	244 kg.	259 kg.	280 kg.	312 kg.
The carriage allows of elevation	20 degrees.	22 degrees.	21½ degrees.	19 degrees.
The carriage allows of depression	8 degrees.	10 degrees.	4 degrees.	7 degrees.
Height of fire	900 mm.	1,085 mm.	1,067 mm.	1,050 mm.
Number of charges on carriage	1 case shot.	.....	4 case shots.	2 case shots.
Number of charges in limber	12 shells. 12 shrapnels.	24 shells. 12 shrapnels.	12 shells. 24 shrapnels.	24 shells. 20 shrapnels.
Number of charges on limber	2 case shots.	4 case shots.	.....	2 case shots.
Total number of charges on gun	27	40	40	48

Note.—Krupp's light 7.5-cm. gun presents the following advantages as compared to the Austrian, English and Italian field guns of the same calibre:

a.—The gun, with equipment complete, weighs only 975 kg.; it can be drawn easily by four horses, and the load to be moved by each amounts to only 244 kg., against 259 kg. (for six horses) with the Austrian, 280 kg. with the English, and 312 kg. with the Italian gun.

b.—The small width of track (1.250 mm.) admits of proceeding on narrow roads which are not practicable for ordinary field guns.

c.—The wheels of the Krupp gun are 50 mm. larger in diameter than those of the Italian, and only 60 mm. smaller than those of the Austrian gun. Hereby an easy movability seems secured even on intersected ground.

d.—The small weight of the various parts facilitates the gun being taken to pieces and being carried wherever the impracticability of mountainous districts should require it.

Against these advantages there is the only disadvantage that the limber carries less ammunition than with the other field guns. This inconvenience, however, can be easily balanced by a slight augmentation in the number of ammunition wagons.

their explosion. These advantages have been in the ratio of the increased use of rifled guns.

Faulty systems of rifling and projectiles have subjected rifled guns to strains more dangerous than those due simply to powder combustion. And Rodman said that the measure of strength and endurance of a gun could never be ascertained, until projectiles were made that behaved uniformly. The earlier projectiles were of hard metal, fitting mechanically the peculiar form of the bore, as in the old Whitworth and Lancaster guns; and projectiles having soft metal studs or ribs to fit grooves, used with the first rifled French guns. These are being abandoned because of windage, giving unsteadiness to the projectile at the start, and because of injury to the bore from escaping gas.

The expansion and compression systems give the advantage of steadiness to the projectile, and prevent rush of gas over the shot and the wear of the bore. The latter method gives the best results. It suppresses windage, and though it increases the strain on the gun, they are now built strong enough to bear it. The method now adopted for the field gun, by all European powers except England is that of causing the projectile to take the rifling by means of a copper band forced into a groove near its base: this band answers as a gas check.

The latest devised and best method of preparing projectiles for rifled guns of large calibres, is by using two soft copper rings, one at each end of the cylindrical portion; that in front centres the projectile, and that in rear rotates it and acts as a gas check. This method has many advantages over that of jacketing projectiles with soft metal.

In the improved shrapnel shells, the walls are constructed on wrought iron, or steel plate; by this means there is a gain of strength and lightness; more bullets can be put in, and they are more destructive. The most complete cannister is now made by using a sheet-iron case.

In the shrapnel shell, to insure its action, combined time

TABLE "G."

TABLE SHOWING PRECISION OF FIRE OF EUROPEAN FIELD GUNS IN 1880.

The greatest effective range of these guns, using common shell, is from 5,000 to 8,000 yards. The greatest effective range of these guns, using shrapnel shell, is from 3,000 to 3,800 yards. N. B. 50 per cent. of the shot will fall within the length or breadth given; 25 per cent. within the rectangle formed by multiplying these two dimensions together.

	Austrian.				English.				French.				German.				Italian.				Russian.				English Experimental.			
	8-c. m.		9-c. m.		9-pr.		16-pr.		8-c. m.		9-c. m.		8-c. m.		9-c. m.		7-c. m.		9-c. m.		4-pr. H.A.		4-pr. F.B.		13-pr. M. L.		13-pr. B. L.	
	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.
	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
At range of 2,500 yards.	90.2	20	96.9	19	134.4	14.16	132.6	11.88	62.9	7.9	70.2	9.1	111.5	11.8	95.1	9.8	111.5	11	62.5	13.5	108.8	17.4	90.2	10.8	102.6	6.1	64.6	6.9

and percussion fuses have been recently adopted. Every improvement in this form of shell is of vast significance. The heaviest and most powerful shrapnel shells are deemed indispensible in field artillery, that it may maintain its position of power in its relation to the infantry arm. The losses per minute occasioned by the fire of this projectile, at from 2,000 to 3,000 yards, are four to one as compared with the common percussion shell. The object is to increase velocity of flight of the shell, increase the number of contained projectiles, and at the same time to diminish the force of rupture.

Shells and shot of special construction designed for the penetration of armor have been devised. The first forms

TABLE "H."

COMPARATIVE TABLE OF FIRE OF EUROPEAN 6-INCH RIFLED HOWITZERS.

PIECE.	Calibre.	Initial velocity. Feet.	Elevation.	Range. Yards.
German, 15-c. m. B. L. howitzer (Krupp's system) steel..	5.9	979	45°	6,550
English, 6" 3 M. L. howitzer (steel-tubed, wrought iron hoops).....	6.3	.....	15°	3,164

COMPARATIVE TABLE OF FIRE OF EUROPEAN 10 AND 11-INCH RIFLED HOWITZERS.

PIECE.	Calibre. Inches.	Initial velocity. Feet.	Elevation.	Range. Yards.
Krupp, 28-c. m. B. L. howitzer, steel.....	11.023	1,030	5° 30′ 22° 30′ 60°	2,115 6,349 6,846
English, 10-inch M. L. howitzer (steel-tubed, wrought iron hoops)	10.	.....	40° 60′	4,816

of these were of cast-iron, but the most improved are of steel, cast and forged, experiment having shown that they are least likely to break up on impact.

BREECH-LOADING.

Before 1866 comparatively few rifled cannon were made on the breech-loading principle, as it was thought that whatever the form of construction, they were necessarily weaker than muzzle-loading guns. No really good system of breech-loading was then known, and the only power then using breech-loading field artillery was Prussia, England

having gone back to the muzzle-loader. One of the most important discoveries in gunnery, is, that the powder charge should always occupy the same space. To use the powder chamber in a muzzle-loader and insure this condition, a choke must be formed to stop the projectile at the same point in ramming. This makes it difficult to properly sponge, and a liability to danger which is not the case with the breech-loader.

Great improvements in the mechanism of breech-loaders have been made in the past fifteen years; they have been simplified and made perfectly reliable; they have been thoroughly tested in war, and breech-loading field guns have been adopted by the great European powers, England excepted. In the use of field breech-loading guns, steel shields may, and will be employed to protect the gunners from bullet fire as they remain behind the piece in loading; while in heavy guns, the service of the piece is performed more rapidly, conveniently, and with greater safety to the gunners. The most efficient and durable gas-check for breech-loaders, is the Broadwell ring, and it is invaluable in large guns. It is of steel, is easily applied, and at the discharge of the gun is instantly expanded, and pressing rearward hermetically seals the tube preventing all gas escape.

Briefly stated, improvements in breech-loading have been a gain to artillery, in initial velocity; accuracy of fire; in the protection afforded gunners in guns of all calibres; in rapidity of loading heavy guns; and in greater safety from more complete sponging of chambered guns.

POWDER.

In 1860 General Rodman suggested the idea of gradually developing and regulating the force of gun-powder. It was found that with ordinary grain powder, the evolution of gas was greatest when the velocity of the projectile was least and *vice versa*; causing excessive strain at the seat of discharge, and a too rapid diminution of pressure from that point forward; nearly the whole charge being consumed,

while the shot was passing about one-fourth the length of the bore; the ordinary powder being too sudden in its action. This was at the beginning of the period of large ordnance, both rifle and smooth-bore, and it was a most important discovery, to be able, in the manufacture of powder, to obtain increased velocity of the projectile with a diminished strain on the gun.

This power conferred, of producing higher velocities with lower pressures, is a great advance in efficacy of fire; as high velocities give flat trajectories.

ARTILLERY CARRIAGES.

As the heaviest gun that can readily be manœuvred in the field is the best, the most valuable improvements, have been those in the direction of lightness consistent with required strength. There is here no question of the superiority of iron and steel carriages over those of wood, and the former are now in use in most of the field artilleries of Europe; though the period of iron field carriage construction is in its infancy. Already the replacement of iron by steel is contemplated, as a measure giving still greater mobility, with far greater strength, in carriages and limbers. To counteract the effect of recoil from high charges, so important to initial velocity, a hydraulic buffer has been introduced in the Russian artillery carriages. It receives the shock of discharge before this is communicated to the lower parts and wheels, and it is now adopted in Russia for all field guns.

In heavy ordnance the material and mechanism of carriages, and appliances for working heavy guns, have undergone great changes in the past twenty years. Iron carriages have supplanted those of wood, while hydraulic and steam machinery, as well as greatly improved manual machinery have been introduced, for easy and rapid manipulation.

The energy of recoil is now partly absorbed, or it is stored up and utilized, in running the piece into battery: and it is in the perfection of this last device that much may yet be

accomplished. Still later inventions, in many respects greatly advantageous, are those entirely preventing recoil, either by centrally pivoting the gun, or by transfer of the shock of discharge to masonry at the muzzle.

IMPROVED SIGHTS.

As it is obviously impracticable to employ with precision, the great range of modern guns without artificial aid to sight, telescopic sights have been resorted to and with the best results. The gain is more exact aim; accurate aim at distances equal to the range of the gun; advantage of observing the effect of the shot; and enormous increase of destructive power at long distances. The results of experiments by the French in accuracy of fire, with and without the revolving telescopic sight, are, at 2,700 yards, as 6.8 to 1, and at 5,100 yards the difference in accuracy is more than as 20 to 1. It admits of ready application to field guns by supplying them with a bracket in which the sight can rest. The revolving sight with lens, without the telescope, can be used in the same manner with a considerable gain in accuracy. Accuracy of fire has also been much improved experimentally, by the use of the wind guage, in determining allowances for the wind; and has stimulated the study of effects, by similar experiments, of drift, wind, sun, inclination of sights and other sources of error, in the aggregate, of large importance.

RANGE FINDERS.

Other auxiliaries to precision of fire equally weighty, are methods of rapidly determining the proper range. They are of special value in vertical fire and on the sea-coast. In vertical fire the angles of descent are so great that unless the object is large, an error of a few yards might render the fire worthless. And on the sea-coast, the approximate range must be quickly arrived at, or a hostile vessel may steam beyond danger. During the last twenty years many instruments for measuring distances have been devised. Nearly all are concerned with the rapid solution of a triangle, one

of whose sides is the distance to be determined, and another is a base of known length.

MACHINE GUNS.

Properly classed with artillery, are modern machine guns, which in future wars are to play an important part. Though hardly yet a competing arm with artillery, they are, for special purposes, invaluable on land and on shipboard. They are the legitimate offspring of a mechanical age in which everything tends toward greater economy of labor; since whether employed defensively, or offensively, they enable a few to do the work of many; and in this sense, are the most complete embodiment of the term machine of war. The rifle firing machines have ammunition interchangeable with that of the infantry arms. They discharge from 200 to 500 shots per minute with precision, and a range but little inferior to that of the best breech-loading small arms. Their weight is great compared to the charge, and there is no disturbance from recoil. The machinery is simple, is little liable to get out of order; and for flanking ditches, firing against columns, or moving bodies of infantry, cavalry, or parks of artillery, these guns are invaluable.

It is urged, however, that in obtaining an effect from a machine gun of this calibre, equal to that of about fifty men armed with the breech-loader we are liable to lose the whole at any moment, from the crippling of any of the parts of the gun; and that the equipment in men, horses and material, of a battery of these guns is cumbrous compared with soldiers; and that such guns can always be antagonized by a few superior marksmen. While it is manifest that such a gun with the range of small arms cannot be successfully opposed to artillery, yet if acting against infantry alone it would be very destructive; while a gun shield, rifle-proof, interposed in front of its gunners, would prevent their being picked off. It is estimated that the maximum loss from the fire of a battery of six Gatling guns, rifle calibre, against an

infantry line, at from 2,000 to 2,500 yards, would amount to more than 100 men a minute; and that it would require 400 men to defend a position as efficiently as ten machine guns, the men being armed with breech-loaders.

The Hotchkiss revolving gun adopted by the United States and by seven other nations, consists of a group of five barrels, revolving in front of a solid breech piece. With it, 80 rounds a minute can be fired, or 60 rounds with deliberation; each shell bursting as a rule, into 20 different fragments: "So that a continuous and deadly fire of 75 pounds of metal or 1,200 hits per minute are produced." Compared with the modern field gun its merits are, equality of range; greater capacity for delivering a deadly, incessant and wide spread fire at all field ranges, and with greater rapidity; stability when fired, and evident superiority in pursuing retreating columns. It can pour a continuous stream of fire upon distant, near, or changing points; its rapidity of fire assisting in almost immediately determining the range, and as the gun is without recoil it can be held there. The power of a battery of six of these guns, compared with a battery of six 3-inch rifled guns, firing shrapnel at from 2,000 to 3,000 yards, is more than as 9 to 1. Its value is daily becoming more and more recognized, in Europe and in Asia, both for field service and for fortified places.

IMPROVEMENTS IN SMALL ARMS.

As early as 1860 the infantry fire-arms of all Europe, and of the United States, had undergone a complete change in the substitution of the rifle and elongated ball, for the smooth-bore and spherical ball. But the principles involved in the change were imperfectly understood, and the armaments of Europe represented sixteen different kinds, then adopted, for infantry use. These differed in the number and depth of grooves; in their twist; and in the form and weight of the ball; and they embraced eight different systems of expanding the ball into the grooves. Among the best of these systems, was that of the Greener–Minié, or

hollow ball, adopted by the United States and by nine European nations. The arms of this system were in general efficacy equal to any others; and but little inferior in range and penetration. They were easily loaded and gave ready expansion to the ball. The rifles and rifled muskets of the United States, compared favorably with those of other nations, resembling more the English;—but in material, manufacture and finish they were inferior to none, though surpassed in accuracy by those of the Swiss. At the same date, breech-loading small arms had been introduced, but to a very limited extent, into European service. In Prussia part of the infantry were armed with the breech-loading rifle; in Sweden and Norway the same; and in France the Cent Guards were so armed. With these exceptions no breech-loaders were in the hands of European infantry. In our own service there was a variety of breech-loaders, very limited in number and on trial as a matter of pure experiment. They all belonged to the old system of breech-loaders, characterized by some form of the percussion cap. Table "I" shows the relative powers of the best infantry service rifle in use in the United States, in 1861 and in 1880; and these are compared with the Martini-Henry, and with the long range infantry rifle; these latter being arms of extreme range.

The ball cartridges in use in 1861 had the paper envelope, containing in the same case, both ball and powder, the percussion caps being carried separately. Cartridges were of two general classes, that in which the ball was in contact with the powder, and that in which they were separated.

The general results of the improved arms of that time, were, that infantry fire over the smooth-bore, was at least four fold more efficacious; and that a destructive fire could be maintained up to 860 yards. The superiority of the breech-loader was not denied as to the confidence it inspired in the individual; and for defensive emergencies, where rapidity of fire compensates for numerical inferiority; but

it was urged that they were complicated in mechanism, easily fouled by escape of gas, and that their ammunition would in the main, be quickly and inefficiently expended.

The most sharply drawn lines in the improvement of small arms since 1861, are those separating the muzzle-loading from the present breech-loading methods, giving advantages to the latter of great range, power and accuracy; greater certainty and rapidity of fire; greater security from accidents in loading; and greater facilities for loading under all circumstances.

Formerly the most serious defect of breech-loading arms was the escape of gas through the joint of the fermature. This was at first overcome by packing the joint with a thin steel ring or gas check, but now the metallic cartridge case is a perfect gas check, and prevents the machinery of the gun from fouling and wearing.

These self-primed, centre firing cartridge cases, form one of the most marked improvements in modern fire. The operations of loading are by it greatly simplified; the case is strong, does not lose its figure, and protects from injury both powder and priming; the proper quantity of powder is always used, and the axis of the projectile is in the axis of the bore. Cartridges can be transported with safety and are not affected by moisture. Of the two main divisions of breech-loading mechanism, the rotating and the sliding, the former is the best. As the diameter of the chamber is a little larger, and that of the bore a little smaller than the projectile, loading is facilitated, and the projectile is compressed and firmly held by the lands in passing through the bore; effectually suppressing windage, and compelling the ball to conform to any degree of increasing twist of grooves. This was not always the case with the muzzle-loader, as projectiles of small calibre, have but little inertia, and do not expand well into the grooves. It will be also observed, that this slugging of the projectile, has led to smaller calibres for rifled arms; giving the further advantage of

reduction of weight of cartridges, for the same number of rounds, to be carried by the soldier.

The Martini-Henry rifle, adopted by England, is one of the most powerful now in use in any service, both in range and penetration; though it has less muzzle velocity than most others owing to the comparatively great powder space of the shell. By comparison of our service rifle, with those of European countries, (Table "J.") it will be seen that it is about equal in power to any except the Martini-Henry. The angle of the trajectory of shots from all these arms (except the latter) at 2,500 yards is about 50°; the dangerous zone is therefore very narrow, and a small target at long range is extremely difficult to hit. Their effect and dangerous zone at 2,500 yards are about the same as those of the Swiss federal rifle of 1861, at 1,400 yards; and it had a flatter trajectory than any European rifle of that date.

Their fire, therefore, at ranges above 2,000 yards, has little value, except from fixed positions, and against deep targets, as masses of troops; and even then a large amount of ammunition would be consumed, in comparison with the damage done.

The United States cavalry carbine has been made almost as effective, as its service rifle; it having with the use of the rifle cartridge, a penetration and a man killing power at 2,000 yards, and more, nearly equal to that of the rifle while the recoil is no greater.

By modifications in construction, and the improved cartridge, the cavalry pistol of 1881, is, in rapidity and convenience in loading; in the prevention of gas escape, and in the preservation of ammunition, greatly the superior of that of 1861.

In aggregate results of range, penetration, accuracy and rapidity of fire, a gain of power in small arms in the last twenty years, may be safely asserted as eight times greater in accuracy; two-thirds greater in range and penetration; and five times greater in rapidity of aimed fire; while the

TABLE "I."

KIND OF RIFLE.	Total weight of rifle with bayonet.	Calibre.	Weight of ball.	Weight of powder.	Penetration in white pine at 200 yds.	Penetration in white pine at 1,000 yds.	Accuracy at 300 yds.		Accuracy at 1,000 yds.		Angle of elevation at 300 yards.	Angle of elevation at 1,000 yards.	Muzzle velocity in feet
							Vertical deviation.	Horizontal deviation.	Vertical deviation.	Horizontal deviation.			
							Inches.	Inches.	Inches.	Inches.			
New rifled musket in use in 1861	9.90 lbs.	.58"	500 grains.	60 grains.	11 inches.	3¼ inches	9	7.3	55.9	25.5	40′	4°,15′	963
1880—Springfield rifle, now in use	9 lbs. 13 oz.	.45"	405 grains.	70 grains.	.....	.....	2.64	2.36	16.8	9.23	38½′	3°,6′	1,369
1880—Martini-Henry, now in use	9 lbs. 12 oz.	.45"	480 grains.	85 grains.	.....	.....	2.8	3.8	14.55	10.9	42′	3°,18′	1,250

KIND OF RIFLE.	Penetration in white pine at 2,000 yards.	White pine penetration at 300 yards range.	Elevation at 2,000 yards.	Weight of powder charge.	Weight of ball.	Extreme range. Yards.	
Springfield service rifle, 1881	1.5 inches.	10.75 inches.	11°,58′	70 grains.	405 grains.	2,900	With 500 grain bullet may be increased, in range, to 3,500 yards.
Springfield long-range rifle, 1881	Through 3 in. target.	.....	8°,16′	80 grains.	500 grains.	4,100	
Martini-Henry, 1881	Through 3-in. target.	14.25 inches.	9°,48′	85 grains.	480 grains.	3,100	
	at 2,500 yards.		at 2,500 yds.				
Springfield service rifle, 1881	1.12 inches.	.....	17°	70 grains.	405 grains.	.....	
Springfield long-range rifle, 1881	5.25 inches.	.....	10°,38′	80 grains.	500 grains	.....	
Martini-Henry, 1881	2.5 inches.	.....	13°,30′	85 grains.	480 grains.	.....	
	at 3,200 yards.		at 3,200 yds.				
Springfield long-range rifle, 1881	2.5 inches.	.....	20°,51′	80 grains.	500 grains.	.....	
Martini-Henry, 1881	Failed to strike target	.....	26°,51′	85 grains.	480 grains.	.....	

weight of cartridges has been diminished, and the number per man that may be carried increased. Considering the relative areas of effective fire, consequent upon increased range, it will be found that that of the modern breech-loader is thirty-two times greater than that of the old smooth-bore; and that the quantity of aimed fire is five times greater.

Still it is to be borne in mind, that the limit of distinct vision gives a relatively less advantage compared with its range, to the long, than to the short range arm.

The pre-eminence of the modern breech-loader, has been effected by the utter suppression of windage and gas escape; by the perfect rifling motion; by the improved cartridge; by the removal of inaccuracy consequent upon ramming; and by an increase in the weight of the projectile as compared with its diameter.

Repeating Rifles. Closely following the advent of breech-loaders, were repeating arms, and they are steadily pressing for the position, foremost in importance, as weapons of the future. "By the repeating rifle showers of balls may be thrown at a critical moment when a sudden increase in the intensity of the firing might decide a contest; and there is less danger of surprise to troops so armed." Switzerland, France and Norway have to some extent, adopted repeating arms; and the Turkish cavalry were armed with them in the war with Russia. It is self evident, that given equal accuracy and range, a gain in rapidity of fire is very material; and it may therefore be assumed, that in the general adoption of the magazine rifle, nations will delay no longer than may be necessary to determine its most advantageous form.

CAVALRY.

From the earliest dates horsemanship has been held in high regard, therefore development in this particular, would hardly be expected. Cavalry, as it now exists, dates from the organization of his standing army by Charles the

TABLE "J."

DATA RELATING TO THE SMALL-ARMS OF THE LEADING NATIONS OF THE WORLD—1881.

NATION.	United States of America.	England and Turkey.	France.	Russia.	Prussia.	Austria and Hungary.
ARM.	Springfield.	Martini-Henry.	Gras-Chassepot.	Berdan.	Mauser.	Werndl.
Weight of rifle without bayonet	9 pounds 1.6 ounces.	8 pounds 12 ounces.	9 pounds 4 ounces.	9 pounds 4 ounces.	9 pounds 10 ounces.	9 pounds 3 ounces.
Weight of rifle with bayonet	9 pounds 13 ounces.	9 pounds 12 ounces.	10 pounds 8 ounces.	9 pounds 12 ounces.	11 pounds 5 ounces.	10 pounds 14 ounces.
Length of rifle without bayonet	4 feet 3.9 inches.	4 feet 1.5 inches.	4 feet 3 inches.	4 feet 2-38 inches.	4 feet 5 inches.	4 feet 2 inches.
Length of rifle with bayonet	5 feet 9.8 inches.	5 feet 11.5 inches.	5 feet 11 inches.	5 feet 10.38 inches.	6 feet.	5 feet 9 inches.
Calibre across the lands	.45 inch.	.45 inch.	.433 inch.	.42 inch.	.433 inch.	.421 inch.
Inclination of grooves	1 turn in 22 inches.	1 turn in 22 inches.	1 turn in 21.66 inches.	1 turn in 20 inches.	1 turn in 21.66 inches.	1 turn in 28.74 inches.
Number of grooves	3	7	4	6	4	6
Extreme graduation of sight	1,600 yards.	1,400 yards.	1,968 yards.	1,200 yards.	1,750 yards.	1,161 yards.
Weight of bullet	405 grains.	480 grains.	386 grains.	368 grains.	386 grains.	371 grains.
Weight of powder charge	70 grains.	86 grains.	81 grains.	77 grains.	77 grains.	77 grains.
Weight of cartridge, complete	611 grains.	766½ grains.	676 grains.	600 grains.	660 grains.	656 grains.

VELOCITIES AND ENERGIES.

Ranges	Yards. Muzzle	Yards. 1,000	Yards. 2,000	Yards. 2,500	Yards. Muzzle	Yards. 1,000	Yards. 2,000	Yards. 2,500	Yards. Muzzle	Yards. 1,000	Yards. 2,000	Yards. 2,500
Velocities	Feet. 1,350	Feet. 534 5	Feet. 393.2	Feet. 280	Feet. 1,252.8	Feet. 573.9	Feet. 372.2	Feet. 316.2	Feet. 1,430	Feet. 553.5	Feet. 343.2	Feet. 288.4
Energies	Ft. lbs. 1,639.4	Ft. lbs. 257	Ft. lbs. 99.9	Ft. lbs. 70.5	Ft. lbs. 1,673.8	Ft. lbs. 372.2	Ft. lbs. 147.7	Ft. lbs. 106.6	Ft. lbs. 1,753.1	Ft. lbs. 262.7	Ft. lbs. 101	Ft. lbs. 71.3

Ranges	Yards. Muzzle	Yards. 1,000	Yards. 2,000	Yards. 2,500	Yards. Muzzle	Yards. 1,000	Yards. 2,000	Yards. 2,500	Yards. Muzzle	Yards. 1,000	Yards. 2,000	Yards. 2,500
Velocities	Feet. 1,384.9	Feet. 552.6	Feet. 345.2	Feet. 290.6	Feet. 1,410	Feet. 551.2	Feet. 342.6	Feet. 288.1	Feet. 1,437	Feet. 550.9	Feet. 347.7	Feet. 292.3
Energies	Ft. lbs. 1,567.6	Ft. lbs. 249.6	Ft. lbs. 97.4	Ft. lbs. 69	Ft. lbs. 1,704.4	Ft. lbs. 254.5	Ft. lbs. 100.6	Ft. lbs. 71	Ft. lbs. 1,709.4	Ft. lbs. 256.3	Ft. lbs. 99.6	Ft. lbs. 70.4

II, of course varying in armament, and tactics. The last two great European wars have added little to the art of handling cavalry; though prior to, and at the battle of Mars-la-Tour the Prussian cavalry showed itself as efficient as any in the world, in first aiding to carry out strategic plans, by masking operations in its rear and then by valor on the field, in gaining breathing time at great sacrifice to over-worked and exhausted infantry. Greater attention than formerly is now paid to the selection of horses, and to the diminution of weight carried in cavalry service; as it is seen, that upon rapidity of movement, whether or not under fire of modern arms, depends very largely, the offensive power of cavalry. Abroad, much has been gained, by the importation of valuable stallions and brood mares, to encourage the breeding of a suitable class of cavalry horses. In equipment, improved saddles and lightness of parts, distinguish the new, from old forms, while there is equal strength and durability of material. Cavalry are now armed with a carbine efficacious at 2,000 yards and with a revolver killing at 300 yards, which may be loaded and fired eighteen times (three rounds) in two minutes, beginning with empty chambers. "Sheridan and other leaders in our civil war threw aside the traditions of European cavalry, jingling brilliant and costly, a massing and charging force," and made our cavalry an offensive and self-defending power against all arms. In the position in warfare which it then assumed, as well as in the new future opened to it, the present armament of carbine and pistol will contribute powerfully to maintain its relative importance, as it will be more frequently called upon to rapidly move at a critical moment, and fight as infantry.

SHELTER TRENCHES AND INTRENCHING TOOLS.

In one form or another, the idea of field intrenching is a very old one; but the rapid development of modern fire has given to the subject an importance it never before possessed. It was thoroughly appreciated, and never more effectively

practiced, often with the simplest or improvised implements, than by the soldiers of our civil war.

"They waited neither for orders, deployment of skirmishers, or formation of lines, the rule being that troops proceeded to this work without orders; the result was that the American soldier became an adept in intrenching himself." Experience demonstrates the great value of field intrenching, even when extemporized and constructed in the presence of the enemy. General Wright says: "The attack on Petersburg of nearly two divisions, against a a picket line, covered by a simple trench and parapet, cost us in killed and wounded, a number equal perhaps to the entire force of the enemy opposed to us." So satisfied of the value of the simplest cover, were the Russians, in the war with the Turks, that no time was lost in creating a shelter of some sort, at every probability of a battle. Intrenching is now part of the work of fighting, and the intrenching tool is indispensible in the field equipment. Hasty ideas that the bayonet had become a weapon of questionable utility, joined to the fear that it would be rash to abandon it, have created the device of bayonet and intrenching tool united in the same implement. But a spade cannot be made a bayonet and a bayonet is useless as a spade; and more mature considerations, looking to a serviceable intrenching tool, and that a certain number should be carried with every infantry and every cavalry company, always ready for use, are by far the wisest, and have generally been adopted. Neither the best form of intrenching tool, nor the best mode of transporting it, is yet settled upon. If the soldier be burdened with an implement unduly wearying, he cannot be depended upon to retain it through a battle or a long march, even though it be not above two pounds weight, the extreme limit. And if parts of a larger tool are carried by two or more men, some might be missing with the men, at a critical moment. There are many obvious objections to carrying tools on mules or in carts.

Experience has proved, that men individually provided with a small intrenching tool, easily carried, and serving at the same time as a cleaver, will provide shelter trenches of the simplest order for themselves in fifteen minutes; and with picks and shovels (which may be carried in wagons) in thirty minutes. The positive gain in the subject of intrenching, has been in the official recognition of the necessity for organization of effort; and in the prescribed means for that effort; in the instruction of the soldier, in the method of intrenching, and in the principles to be observed in tracing lines. The essential points settled, are, that trenches must resist rifle bullets; afford cover to the soldier in firing positions; be easy of execution; and be no obstacle to offensive movements.

ARMORED DEFENSES.

In permanent works, the power of modern guns has likewise dictated changes in the "Art of enabling the weak to resist the strong," both on the sea-coast and in the interior. Reference is here made only to methods devised for protection against curved and direct fire, and not to modifications of traces and dimensions of permanent works, which belong to another part of our subject.

To further secure inland fortifications, the walls have been strengthened by an increase of from two and a half to three times the former thickness; as they are not exposed to the fire of the heaviest guns. But sea-coast and river defenses are exposed to attacks from the most powerful ordnance. Thickness in walls cannot here be indefinitely extended, because of practical difficulties in sub-structure, and because of like difficulties in the construction of proper embrasures. Iron has therefore been resorted to in the formation of shields and turrets for the guns; and walls of iron substituted on the sea fronts of fortifications.

Attention was first directed to its application to these purposes in 1860. The gun shields for case-mates and open batteries are now formed of three or four, five-inch iron

plates, at intervals of five inches apart; the intervals being filled with iron concrete. Rope mantlets are used to protect the gun detachment, and to keep out smoke.

Curved fronted shields, each pierced with two ports have also been adopted; the case-mate being of the ordinary character, and each port afforded an angle of training of sixty degrees. The sea-coast turret is a cylindrical wall of iron armor with a bomb proof top, and holding one, or two guns. It is revolved by steam power, One gun commands the entire circle; the gunner readily training it in any direction. Similar turrets of chilled cast-iron, revolved by hand, and with the base protected by a glacis, have been employed for land defences, by the Russians, Germans and Dutch.

They are of great advantage in advanced positions, or, in the angles of the main work. The most powerful service guns give a penetration in iron of nearly thirty inches, and the best masonry is wholly unequal to the shocks of their projectiles; it will therefore, readily be seen, why continuous iron walls, with iron bomb proof roofs are very desirable in sea fronts of fortifications, and in fortifications advanced from the coast on isolated points of land.

The advantage of iron armor defence further appears, when it is considered that these powerful guns are carried by steam vessels, presenting small target surfaces, moving rapidly to any position, and so protected by armor plating, as to be comparatively safe at ordinary ranges. It is self-evident that without shields, gunners would soon be driven from their guns by grape and case shot; and that the destruction of exposed masonry would be a question only of a few minutes.

FIELD TELEGRAPHY.

This subject received but little attention prior to the Italian war, but during our civil war, and since, its operation as a system has been perfected.

Our telegraph corps, as well as those of Europe, are now

thoroughly equipped, and connection between the principal headquarters, and those of different army corps, may be established in a few minutes, on the halt of an army, or in its preparation for battle. The best organizations are those of the Prussian and Austrian service. In the former, each army corps and army headquarters, has a complete telegraphic division of 137 men and 10 wagons. Eight of the wagons carrying five miles of wire each, and two, the apparatus for work. During the Franco-Prussian war, besides keeping the king in communication with his ministers, the general headquarters were always promptly connected with those of corps. The lines were kept closed up as the army advanced, so that movements on the field were directed from the closet.

The use of improved instruments, and the invention of the telephone, greatly simplify the field telegraph, as any one may now operate a line; and there will be removed the difficulty of reading by sound, always troublesome in the neighborhood of conflict. Strong and flexible wires are now insulated, and run off from reels on light carriages, so that lines may be readily extended over any obstacles of country, without interfering with the march of troops. Upon the timely knowledge of a single fact has depended the issue of a battle; and on the modern field where events more quickly culminate, and rapidly succeed each other, the value of prompt information of changes cannot be over estimated.

TORPEDOES.

Prior to 1861, torpedoes were not regarded as important, as means of offense, or defense: but their capacity in both these relations, has been since then greatly enlarged by mechanical devices, and by prolonged and careful experiments; and harbor defense is not now deemed complete without these channel obstructions.

Thirty-two union vessels were destroyed, or crippled by torpedoes, during the civil war. At home and abroad, torpe-

do, or sub-marine mining schools are now kept up for thorough instruction in this branch. Mines are operated from the shore, and are under complete control, so that anyone, or any group, may be exploded at will.

Attention is here confined to torpedoes fired from the shore, and used as auxiliaries to defense by fortifications; to detain hostile vessels under fire. Considered in this view they will be referred to again.

RAILROADS.

In war, railroads, in a vast country, entirely over shadow the best ordinary roads in importance. And it has been said of our civil war, that it was a contest for the possession of railroads. Indeed distant campaigns, would without them, be often impracticable. Whatever promotes the rapid concentration, or withdrawal of troops, is a mighty factor in strategy. Measures for the improvement of the material of transportation, and for its organization and management, received the earliest attention during our own war; and since that period, in Europe, these questions have been anxiously considered, as there, countries may at the shortest warning be overrun from a hostile border. There are now constructed cars, with special arrangements for the sick; for hospital supplies; medical officers and attendants; cars with special means for loading at the end or sides; cars for animals; for subsistence and war stores, and for portable bridges. The organization of transportation corps in Europe is military, and by gradation of officials; trained surbodinates being divided into special bodies for the details of duty, and united under one head for discipline and direction; this head having a working and personal staff.

The management relates to repair, constructions, stations, loading, shelters, working the line, rate of travel, &c. It is plain that to secure the full advantages of railroads, in the emergencies of war, previous thorough knowledge and organization are essential both in the directing heads and

in the practicing hands, or endless disorder, confusion and delay will characterize the transporting of troops of different arms and corps, with their ammunition stores and baggage.

Improvements in military organization, and in the personnel of armies, have been consequent upon advancement in professional knowledge and the development of means for war.

Better methods of clothing and subsisting; better food, better sanitary and hospital provision, are the out-growth of the material industries of the age; and though they have had, in the aggregate, a marked effect, they are not special forms of improvement in the art of war, controlling or modifying future operations; and we shall therefore here conclude the first part of the subject of this paper.

PART II.

PROBABLE EFFECT OF IMPORTANT IMPROVEMENTS IN THE ART OF WAR ON FUTURE MILITARY OPERATIONS.

Effect on the construction of permanent defensive works.—As is well known, the exterior side upon which the front is based in the bastion modern systems of fortifications is 360 yards.

This dimension was imposed by the effective range of the smooth-bore musket, the principle being, that as the defense was dependent upon two arms of unequal power, infantry and artillery, the sphere of action of that of greatest power, should be subordinated to the limits of that of least power. Hence the length of the fortification front, and of the lines of defense, have depended upon the range of the infantry arm. The relief of the work, has also depended upon this range; for the length of the curtain regulates the relief of the flanks, since its strong defence depends on the fire over their parapets. Assuming that the effective range of the modern breech-loader, is eight times that of the

old smooth-bore, it is plain, that the dimensions of the exterior side, curtain, and lines of defense may be enormously increased, and limited only by the distance of fairly accurate aim say 1,200 yards.

For the same reason much more latitude may now be allowed in the relief of the work, and the long curtain is better defended from the flanks. The front may be increased without lengthening, the perpendicular fixing the salients; and the number of salients diminished; and while the depth of the work is not increased, all the advantages of flanking are maintained. The attack of the salients is rendered more difficult, and there is a great gain of space within the work for the defense.

In lines of numerous salients with small angles, where there is necessarily little space in the interior for the defense, and under old conditions the defense at best weak, the cross-fire is greatly extended by the modern rifle, and the enemy is forced to more distant attacks. The increased range of the rifle also permits the defense of ditches to be dependent entirely upon caponiéres, by using the gun and rifle in the same work. Breeching batteries of the besiegers are more exposed to dangerous fire; and their communications are made more difficult to maintain. The advantages gained to defensive works may be summed up:—in the diminished number of salients; larger lines of defense at less cost; the use of simple lines in uniting strong salients; and the greater unity of artillery and infantry fire.

While great defensive advantages have been thus conferred on the bastion system, the comparative importance of the system itself has been lessened by the great power of modern arms. "The extension of railroads and the telegraph, the multiplication of steam vessels, and the general subordination of all modern appliances to the purposes of war, have vastly increased the mobility of armies; and while their numerical strength is greater than ever, an attacking or besieging force can more rapidly concentrate

than formerly; and the greater accuracy of fire and increase of range of projectiles enables it to attack an important point at a greater distance." These considerations have rendered indispensable larger fortresses and longer defensive lines. While the augmented power of defense; the advantage of long exterior sides; and the greater economy of simple lines, have all united to hasten the change from the bastion to the polygonal system. The former no longer well protects the escarp, of the body of the work, as the flanks may be demolished, and the faces of the bastions subjected to a ricochet fire from a greater distance. On the other hand the polygonal system is independent of the inter relation of length of front, depth of ditch, and command of the body of the place; its exterior sides being limited only by the range of rifle fire, while its trace is applicable to all varieties of surface. "The faces are less exposed to distant fire, and the flanks are better protected from it than in the bastion system; its communications are easier; it admits of a far stronger artillery defense; and proportionally less of its strength is devoted to flank defense. It imposes on the attack more numerous armies, more batteries and heavier artillery; and it renders complete investment very difficult." On the continent of Europe therefore where cities may be attacked by armies from the nearest frontier, it is obvious that the conditions of modern fire will cause the bastion system to be superseded by the polygonal. The line of defense of the enceinte should however be surrounded by one or two lines of advanced detached forts, since a bombardment is practicable at from four to six miles. These lines of forts increase the arc of destructive effect, but present the disadvantage of division of command at a critical moment.

EFFECT OF IMPROVEMENTS ON SEA-COAST DEFENSE.

Reference has already been made to the iron walls, turrets and defensive armor of sea-coast defenses rendered

necessary by the power of artillery, Iron shutters must now be provided for embrasures to prevent gunners being driven from their guns by grape and canister from iron-clads. And defensive shell proof covers, provided for exposed barbette batteries, to protect them from horizontal and curved fire, and also from the fire of machine guns in vessels tops. And even then barbette batteries cannot be reasonably secure in defensive power without depressing gun carriages to carry the guns under cover in loading.

Auxiliary defenses, as stationary torpedoes, should be protected by case-mated batteries with walls strengthened by metal shields. Fortifications should be provided with guns which will penetrate the defensive armor of vessels, at a distance of at least a mile, and proportionate in range and calibre, to that which can probably be brought against them.

As the tendency in ship building, is toward light, swift armored cruisers, of one or two heavy guns, shallow harbors are no longer secure against the heaviest ordnance; and hence the armament of works at such places should be armor piercing guns of accurate fire. In fact the conditions of harbor defense have been revolutionized by inventions in gun making in the last twenty years. In harbors and channels torpedoes should be multiplied; and guns and mortars capable of piercing the sides, and breaking the decks of iron-clads, be mounted in sufficient numbers to insure the destruction of vessels getting into them.

FIELD WORKS.

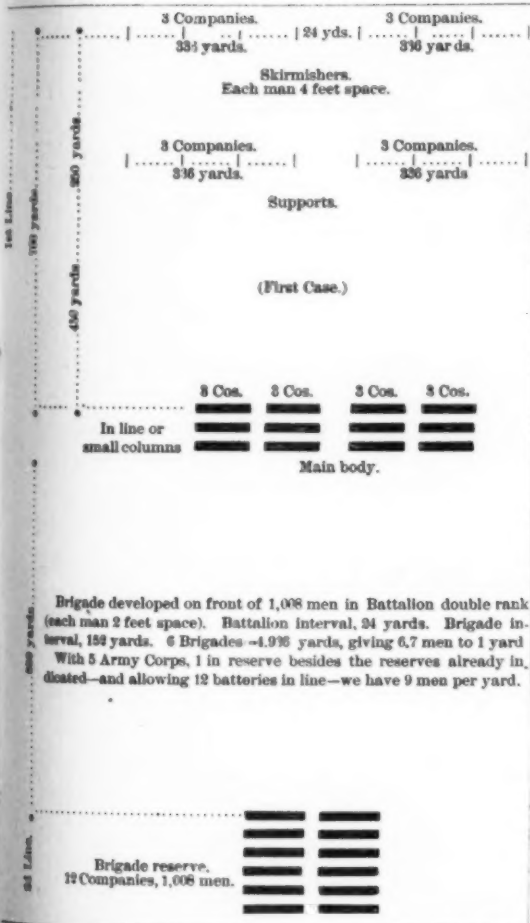
It may be questioned, whether the tendency to cover frontiers with costly permanent fortifications, is not an inheritance of ideas now no longer valuable. Nothing is gained by such lines, merely as lines, if a frontier is equally assailable from many points. And they are of little advantage, except where strategic conditions are such that an enemy must pass, or take a greater risk. "The defence is

TABL

TABLE SHOWING RELATIVE EXPOSURE OF A COMP

FROM PRUSSIAN MUSKET

SIGHT USED.	PERCENTAGE OF HITS ON.			
	Company in Line Standing.	Company in Column Standing.	Company in Line Lying.	Company in Column Lying.
444	50 to 70	60 to 80	15 to 20	25 to 30
777	18 to 35	30 to 45	4 to 10	12 to 25
1555	4 to 10	10 to 14	1 to 3	4 to 8



Brigade developed on front of 1,008 men in Battalion double rank (each man 2 feet space). Battalion interval, 24 yards. Brigade interval, 152 yards. 6 Brigades =4,976 yards, giving 6.7 men to 1 yard. With 5 Army Corps, 1 in reserve besides the reserves already indicated—and allowing 12 batteries in line—we have 9 men per yard.

At Austerlitz there were 4.6 men per metre (French).
At Hohenlinden there were 4.3 men per metre.
Five men per metre are sufficient with modern arms.

One Army Corps. 3 Divisions Infa
Division, each 3 Brigades of 3 Bat
Each Battalion 1,008 men—front p
One Division withdrawn for 3d Li

Each Division 4 Batteries Artillery
Corps Artillery reserve, 6 Batteries

Calvary, 6 regiments. Total, 4,00
Interval between Brigades, 152 ya

First line	12,096 men	Agg
Second line	6,048 men	
Third line	9,072 men	
Artillery	1,800 men	
Cavalry	4,000 men	

Table of losses under different fo

800 men in column at full distance (3 ranks)
250 × no. ranks=750, Equivalent reduction 9,930
400 × 2 ranks= 800, Equivalent reduction 1
7,950 × 8 ranks=58,800, Equivalent reduction 8
1,050 × 8 ranks= 8,400, Equivalent reduction 940
4,758 × 6 ranks=28,548, Equivalent reduction 83
9,930 × 3 ranks=27,990, Equivalent reduction 102
100

It will be seen from this, that the losses increase with depth of formation.

TABLE "K."

OF A COMPANY IN LINE AND COLUMN AT VARIOUS RANGES.

SSIAN MUSKETRY INSTRUCTION, 1877.

ON.		
ay	Company in Column Lying.	REMARKS.
0	25 to 30	At the shorter ranges the column does not suffer much more than the line, both standing. At 1,800 yards its loss is double that of the line, while in the lying position at this range, it is three times that of the line, the proportion being less at the shorter ranges.
0	12 to 25	
	4 to 8	

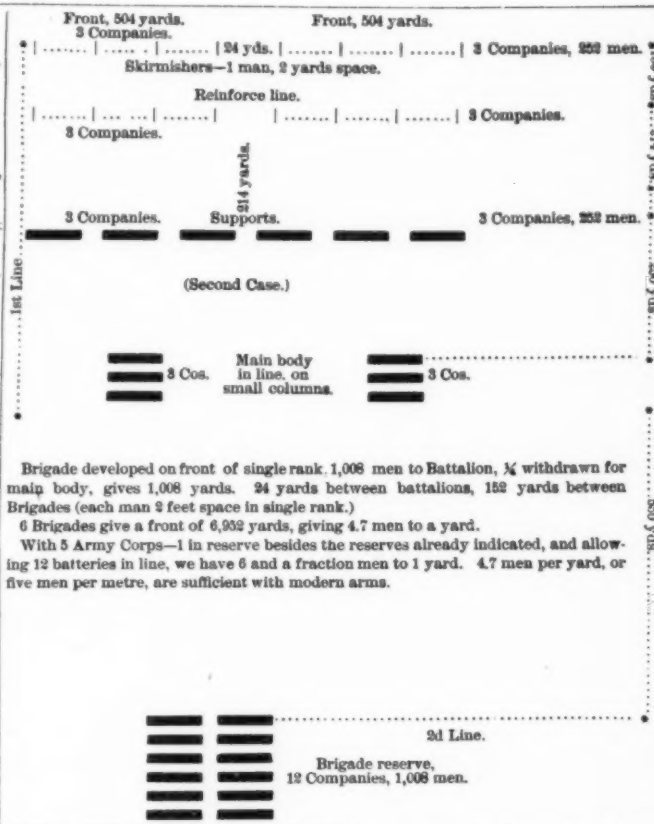
Divisions Infantry, 27,216.
gades of 3 Battalions each.
3 men—front per man 2 feet.
awn for 3d Line as Corps reserve.
teries Artillery } 18 batteries,
rve, 6 Batteries } 100 men each.
s. Total, 4,000 men.
igades, 152 yards.

2,096 men
5,048 men
9,072 men
1,800 men
4,000 men
} Aggregate, 33,016 men, 108 guns.

ler different formations, 800 men.

800 men, 1 rank, 500 metres front, ¼ metre depth..... 250 square metres
800 men, 2 ranks..... 430 " "
800 men in double column (4 ranks)..... 7,350 " "
800 men in close column (6 ranks)..... 1,060 " "
800 men in column at full distance (6 ranks)..... 4,758 " "
800 men in column at full distance (3 ranks)..... 9,930 " "

250 x no. ranks—250, Equivalent reduction..... 1
430 x 2 ranks— 840, Equivalent reduction..... 3
7,350 x 8 ranks—58,800, Equivalent reduction..... 240



Brigade developed on front of single rank, 1,008 men to Battalion, ¼ withdrawn for main body, gives 1,008 yards. 24 yards between battalions, 152 yards between Brigades (each man 2 feet space in single rank.)

6 Brigades give a front of 6,932 yards, giving 4.7 men to a yard.

With 5 Army Corps—1 in reserve besides the reserves already indicated, and allowing 12 batteries in line, we have 6 and a fraction men to 1 yard. 4.7 men per yard, or five men per metre, are sufficient with modern arms.

At Wagram, Austrians had 7.6 men per metre (39.37 inches.)
At Wagram, French had 9.3 men per metre.
At the Alma, Russians had 7.75 men per metre.
At Solferino, Austrians had 10.8 men per metre.
At Sadowa, Prussians had 7.35 men per metre—whole line 14 miles in extent.
At Amanvilliers, Prussians had 10.5 men per metre—whole line 13 miles in extent.
At Essling, French had 24 men per metre (could not deploy.)
At Waterloo, English had 19 men per metre (very dangerous massing.)

forced to seal up a large force in such works, where they are consigned to inactivity, or disconnected effort. The attack may rapidly concentrate, by the facilities of rail and river, a large army of invasion, and leaving a neutralizing force at the point where he cuts the defensive line, pursue his way safe in the conviction that mischief from the scattered garrisons, will not extend more than a few miles from their guns." No resolute commander would pause, for greater advantanges are to be gained elsewhere.

Real defense is in armies, with defensive lines of field works if required. Distances are measured, now as before, by days' marches, whether by rail, steam-ship, or road; but the length of fortification lines are the same as those made a hundred years ago. Unquestionably cities of dominant importance should be fortified. And the general result must be, that larger permanent fortresses, and immense intrenched camps, will displace more expensive methods of permanent lines.

In field works salients, are constructed upon right lines to increase the destructive power by cross-fire, within a given interval; this interval being regulated by the range of the inferior arm. Formerly it never exceeded 330 yards; now, obviously the curtain may be greatly lengthened, while in general the importance of flank defense is diminished.

Greatly increased range now secures to the direct front defense a more powerful cross-fire, without salients, and with fewer men; and a large departure is permissible, in the trace of the works, from the rigid forms, dimensions, and relations of symmetry which heretofore have been regarded as of paramount concern. And field works may now be not only simpler in construction, but strong forms are more readily applied to any ground; a less number are necessary along a given front; and they admit of a more distant defense. Greater power of artillery and infantry fire requires thicker parapets, and higher counter-scarps to pro-

tect the work from indirect fire, and as a better provision against curve fire.

The advantages of accessory defences, in holding the enemy under a rapid fire, at close quarters have been increased, and it is now almost impossible to take a field work by direct assault without overwhelming numbers. Greater mobility of armies will more frequently than formerly, give little time for elaborate construction; and will compel the adoption of forms of field works, which may be rapidly constructed, and best suited for immediate use, but admitting of constant strengthening. But whatever their form, all should be offensively defensive, that they conform to the rapid changes of battle, and to the principle, that the defense must at any moment be ready to attack.

And that all fortified lines may possess the power of attack as well as of defense, lines with intervals are better than continuous tracings. Though the tendancy in field works will be toward simpler lines, it is not to be understood that they may be traced with less care; on the contrary, greater skill than formerly should be exercised to avoid enfilading and converging fire, the assailants having a greater working arc than before.

A cogent aid to fortification defense is the machine gun, especially at points allowing little space and requiring heavy fire, as in salients, flank and ditch defense; one gun being equal to about fifty men, in its volume of fire. As smooth-bore guns and howitzers are invaluable in rough countries, not admitting of long range firing, for grape and canister; so they are equally important at short range for the defense of works.

SHELTER TRENCHES.

The Americans were the first to develope the power of shelter trenches, but since their great war the subject has been carefully considered in every service; and questions of tool-carrying, and the best means of construction of trenches will be speedily settled.

Rifled artillery and the breech-loader will render them more necessary than formerly. The heavier field gun and greater destructive power of shrapnel will often require more than a mere shelter,—even a good parapet where there is time for construction. But everything should contribute to lighten the marching load of the soldier, and the burden of tools, since he must carry all ammunition possible. Above all there is danger of too much intrenching, as it often seriously threatens to destroy the confidence and audacity of the best troops. The shelter trench best serves its purpose, when the soldier is convinced that it is only a resort of a weak line for desperate defense; and merely takes the place of natural cover; that it is to be made the best possible in the time given, and abandoned with indifference at the command for offensive work. Used to connect natural defensive obstacles, or important tactical points, as buildings, woods, they will constitute the defensive lines of future fields; or they may be advantageously used as successive defensive lines on the field. In well selected positions, with advantage taken of natural obstacles, and means of detaining an enemy under their fire at close ranges, shelter trenches well constructed are in general terms unassailable by infantry alone, and in front attacks artillery fire would be indispensable.

While improved arms have immensely increased the tactical power of attack, they have vastly strengthened the hands of the defense whether in permanent or field works, or in the shelter trench. Field lines may be longer and are stronger, and there is a greater value in strong natural positions. In short, whatever detains an assailant under fire at a disadvantage, becomes a strong defensive aid, and it is not to be abandoned until the last instant, unless for resolute counter attack.

Should the attack be able to seize a dominant point of the enemy's line, he not only secures to himself its defensive strength, but the range of modern arms gives to such,

a capture a greater tactical value than when the range was one-sixth of the present.

The greater power of defense will allow a part of a force to be withdrawn from a defensive field line and used elsewhere. Front attacks being hazardous, field intrenching will compel more manœuvering; more frequent flank attacks; and more frequent night attacks, or night movements to positions of attack. Since manœuvering for a flank attack extends and weakens a front, a vigilant defense will be frequently afforded an opportunity for successfully striking an attacking force.

FIELD TELEGRAPH AND RAILROADS.

Since lines of battle, fortified lines, and fortresses, will be more extended under modern fire, such extension will require for purposes of information and command, the liberal use of the field telegraph. Operations removed to distances beyond the observation of the commanding general, may in this way alone, receive, partially, at least, his direction.

Railroads will provide more rapid modes of retreat; and the means for speedily collecting and victualing troops. Both railroads and the telegraph have strengthened the attack strategically, more than the defense. Tactically, they may be of equal value to both, in bringing reinforcements to the field at critical moments.

CAVALRY.

No arm has been more affected by the conditions of modern fire than cavalry. It is probable that the shock tactics of cavalry in large masses will be rarely again seen, though there will always remain its possibility. But more than ever should mounted troops be the antennæ of an army. In the close surveillance of all movements of the enemy, whether remote or on the field, and in masking our own, cavalry will naturally be restricted to operations, generally smaller, but not less valuable, in view of the greater

mobility of armies, the quicker culmination of events of war, and of battle, and the greater necessity for prompt information.

Cavalry charges are powerless in the presence of modern fire against unshaken troops. Under favorable circumstances, and in some great emergency, they may be ordered to save some greater sacrifice, as at Mars-la-Tour.

Cavalry may be held defensively, to charge cavalry which has broken through a weak line, or it may attack the enemy's cavalry to drive it from the field. It may attack demoralized infantry, or isolated batteries, but even such attacks must be supported by infantry, or fresh cavalry, otherwise advantages would be only transitory.

In screening advancing armies and movements on the field; in supporting batteries; in reinforcing rapidly a threatened part of our own lines, or dashing at shaken parts of the enemy's line; in ambuscading, surprising, patroling, foraging and escorting; cavalry is now more important than before. Should infantry ammunition become exhausted, or a fog, or blinding storm prevail, there will be the cavalry opportunity;—similar to that of the wet ammunition of the French at Eylan, and of the Austrians at Dresden. Cavalry united with horse artillery is as terrible as ever in pursuit; in destroying convoys; and in delaying or breaking up marches. If employed massed now, it would be for wide detours to cut communications, destroy railroads, cut off supplies; or to reach the rear or flank of an enemy, or a weak part of his line. Grand charges to carry batteries, or to force lines against unshaken troops, as those of the French at Jena, and Waterloo, should no longer be made, for cavalry so acting, can no longer expect to escape destruction. In this much, cavalry has lost as an instrument of battle; but in view of the greater mobility of armies, and of more rapid results in war, the strain upon cavalry will be far greater than before.

It is the converging power, as well as range of infantry

and artillery fire that makes charges less possible. A charge now essayed by cavalry against infantry must pass through an interval of fire six times as wide, and it must face more than seventy times the amount of fire than formerly, with the old smooth-bore arm; taking nearly four minutes of time; and if in two lines, each line will be exposed to direct and converging fire before it has traversed one-third the interval. If cavalry charges artillery, it will receive more than twenty times the amount of shell fire. Formerly short intervals between several charging lines prevented more than one line being under fire at the same time. Now to similarly arrange intervals would be to cut off support from any advanced line. And it is to be borne in mind that whatever ground favors the cavalry charge contributes in a greater degree to the effective fire of artillery and infantry.

To shelter large masses of cavalry, as a corps or division, from fire on the field, would now generally be to place it so far to the rear that its services could not be had at the supreme moment of opportunity, or necessity. On the other hand, if the country be broken and the mass may be sheltered nearer, such country is unfavorable for the action of cavalry in large bodies. Small bodies therefore of cavalry, apportioned to a division of infantry, would be better sheltered nearer to the lines, and always be available for any service, acting either separately or grouped into larger units. For these reasons and the fact that large masses of cavalry cannot manœuver in front of the enemy's line; and that they can rarely be used without murderous loss; cavalry should not be organized into divisions and corps.

A better arrangement is, that each infantry division should have a brigade of cavalry; and also each corps; then, in exigency, corps and division cavalry may be united.

4,000 cavalry to a corps of 30,000 men, will generally be sufficient. Details should be made from the corps cavalry, leaving the division cavalry intact. Division cavalry

is more important too, since in all future battles fighting will be more individualized whether it relates to army corps, divisions, regiments, or companies: and a division commander should always have the means at hand for complete work, whether of attack or defense.

While there is no need of an assignment of cavalry less than a brigade, there should be this, to protect any part of the line from cavalry surprise. Nor is a brigade too large for mobility. In its position of waiting on the field, cavalry must be sheltered and of as little depth as possible. Jomini considers the best station in rear, and opposite the flanks, and right and left centres, if cavalry be divided. But as its office has changed its station should be that best for service and opposite division intervals; this being now the more necessary from the greater extension of the battle front.

If beyond artillery fire it would be too far removed when wanted; therefore it should take its chances near other reserve troops, and never more than two miles from the enemy's skirmish line.

When at last there is a conspicuous necessity for the shock tactics of the charge, it should be in the formation of greatest shock with least loss. Too much solidity will cause great loss and forbid individual action. It is pretty well settled, and for many reasons that the advance to the charge against artillery or infantry, should now be squadrons in echelon formation. The charge in column must be abandoned. The charge in full line is attended with great loss, and a second or third line may double or triple that loss. The order in echelon divides the enemy's fire, and decreases its precision; and the ground rarely admits of a charge in brigade line. Since dispersed order is the natural order; and since almost all charges resolve themselves into this order over wide intervals; and since losses are least from fire in this order; the dispersed order of squadrons in echelon is the formation best for the charge. By dispersion is not meant loss of formation or disorder. To preserve

unity of effort, the best writers recommend the grouping of men for command, under non-commissioned officers, and for regulating the men in dispersed order. "Grouping does not remove the command from the commanding officer, and it is the best for rallying. This is applicable equally to troop, squadron, or regiment. Drill must impress the intervals, preserve order, and enforce habits."

In cavalry charging cavalry, as there is no fire, the close formation would be better.

A feature of the cavalry of the future will be its raids whether distant or on the field. The more dispersed order of battle, as well as its more extended front will contribute to this use of cavalry; and its success would be quite probable against a gap in the enemy's line, or in its weak extension. Or he may be taken in flank, or reverse, while sharply attacked in front by infantry; such movements would be strengthened by horse artillery.

Defensive cavalry should be more vigilant on the field that surprise may be impossible, either in front or on the flanks. Of course in all cavalry attacks, the principles of supports, and their proportion to the whole strength are as important, as before the change in fire-arms. A united front and flank attack by cavalry, is now more necessary against weakened infantry or isolated artillery.

Improved fire arms have lessened the value of the lance and sabre, and abolished defensive armor for cavalry.

"In all the battles of the last wars of Italy, America, Denmark and France, only two per cent. were wounded with the sabre and bayonet; in the American war on both sides only 1.3 per cent.; and from 1859 to 1870 the ratio of sabre and bayonet wounds fell eleven per cent." *But the trooper should never be without the sharp sabre.* He cannot well load his pistol in conflict, nor can he always dismount to use the carbine; the sabre therefore must still be his last reliance, and as its use is for the trooper mounted it may be carried under the saddle skirts.

The carbine is indispensable for fighting as infantry, in surprises, flank attacks, seizing upon unexpected chances, and for forcing positions at opportune moments, where great results may be achieved by celerity.

The pistol is better for the first onset in individual fighting, and for patroling, pursuing, etc.

The elements making up good cavalry, should be more pronounced than formerly; for its duties are more individualized, and upon their successful execution will depend, often, more than can be estimated, the issue of battle. In the handling of cavalry, more skill will be demanded, especially in the management of the troop unit; as the success of the dispersed order, whether mounted or not, will largely depend upon the courage and capacity of junior officers.

ARTILLERY.

The range and rapidity of fire of modern arms, have affected in a large way the employment of artillery, though not to the extent of other arms. Since the purpose of all fire, is possession of the enemy's line, the general principles of attack and defense will remain the same; but the power and precision of fire varies the form. Against breech-loading small arms, artillery is now the principal support of both attack and defense, and it is therefore of more importance.

Its long range and great precision, breaks up and overwhelms infantry fire; while except at very short range, its advantages are not lessened. It increases the power of the defense in cross-fire, and it confers more upon the attack; whether massed,or by converging fire; while if distributed for methodical pressure of line against line it loses nothing.

On the field, artillery should now prepare the way for infantry, and must support and cover it; and as the companion of infantry, the intimacy of relation of fire will guide its action. By the aid of field lines, and other artificial defense; and in natural obstacles the defense has

gained immensely ; and the attack is dependent upon artillery fire to break up this strength. This work of neutralizing defensive power, demands searching shell fire from guns of great range and precision, high velocities and flat trajectories ; enfilade and oblique fire being resorted to whenever possible. Heavy guns and time shrapnel are the proper agents to secure success. To the defense heavy and powerful field guns are quite as important for accuracy and sweeping range, and for strength of cross-fire.

Since battle fronts under modern fire are greatly extended, the natural method of attack would be by rapid concentration at a decisive point after the enemy had developed his resources. In such attacks the power of artillery should be exerted simultaneously with that of infantry. Since great rapidity and mobility, are requisite for massing in such attacks, the lightest guns consistent with great power would be the best. And as these reserve powers are obviously equally important to the defense, reserve batteries must be at hand in both attack and defense ; or, in the rapid culmination of events on the modern field, defeat would be precipitated. Besides this method of attack, there will always be presented in the long lines of future fields, unexpected opportunities promising success if speedily seized ; and proper artillery must be ready for the work. These considerations therefore, whether applied to the attack and defense of troops in position ; or to the methodical battle ; demand an increase in the proportion of artillery and that there should be two calibres, heavy and light guns and more horse artillery. In the Austrian war, the second army, under the Crown Prince of Prussia had 360 guns to 100,000 men ; the first army under Prince Frederick had 270 guns with 81,000 men. It is now considered that there should be six batteries of six guns each to every infantry division ; and that each army corps should have six batteries in reserve. This assumes three divisions to an army corps, and it includes the horse batteries designed to act with the cavalry. Even

this proportion of artillery is less than that of the French or Russians at Borodino; or that of the French and allies at Leipzig. The ratio of light to heavy guns will depend upon the character of the country and nature of the service; lighter guns being more necessary in a new country with few good roads. Ordinarily one-half or one-third heavy guns will be sufficient.

As corps and division fighting is more separated than formerly, and more independent, it is more important that each corps and division should have the complete means of attack and defense; or of acting for itself as a unit of power. Each should therefore have its own artillery.

Modern fire has greatly enhanced the importance of position in both attack and defense; and has rendered more difficult the choice of a defensive position. Strength, protection, and their own operations are to be considered by the defense; and he must exclude the enemy, so far as is practicable from covering, and from advantageous positions.

For the defense to take an adequate battle front and guard against encompassing, or advantageous positions of the enemy, is a more difficult problem than with arms of much less range and volume of fire. Nor is ground for the attack of so much consequence, as when the range was only a few hundred yards; four or five hundred yards now signifies little for artillery, and the value of artillery tactics has been proportionately reduced. Between attack and defense, advantage of movement, choice of position and concentration at any point, remains with the attack with superior numbers. Artillery has therefore increased in tactical power.

Enveloping movements by the attack, and the manœuvering necessary, affords an opportunity for the artillery of the defense, and any undue extension of lines by the former, to effect this, gives the defense a corresponding advantage, unless there be a great numerical difference of strength.

The decisive points of the defenders line may be now 3,000 yards apart, and they should be powerful artillery

positions. "Dominant points above the general level, secures him against enfilade fire, the same as distance from the front; but in this case, if the elevation be considerable the advantage of the flat trajectory may be lost; and very commanding positions except for great distances are to be avoided;" gentle slopes from commanding ground are best for the long range of modern artillery. The position of the defense should be such as to secure to him the advantage of a voluminous cross-fire as the parts of his line are thus mutually strengthened. A defensive line should have the greatest possible reserve artillery, to mass at the critical moment, to resist the enemy's concentration. The fire of four massed batteries of rifled guns is estimated by high authority as equal to that of an infantry division;—eighty rounds per minute may be fired. There is nothing new in massing artillery. It first lost and then won to Napoleon, Marengo. It gained to him Borodino and Wagram. Imperfect massing caused disaster at Eylan, Friedland and Aspern.

Frederick perceived and availed himself of the advantages of this method. Massing secures unity of effort, concentration of power, and, of course, quicker results. The shock of artillery can be produced only in this way or in the grouping of batteries at different points of a line for concentration of fire. Rifled artillery is eminently fitted for either method, but the proper disposition of it must depend upon circumstances. If the attacking force is superior and the enveloping line of attack is adopted, batteries should not be scattered along the curve with the expectation of concentration of fire, for the reason that they are more or less open to enfilade fire; and the tendency of men is to fire at their own front and upon what is firing at them. Besides there is the practical difficulty of controling a fire, extended along an immense front, and directing it on particular points. Again, but few batteries may be able effectively to reach a given point. Therefore

in such a case, whatever be the objections to massing they must yield to these considerations. By this method of attack, the assailant in outflanking, gains an enfilading fire for his massed batteries; and if the attack is vigorously followed up by infantry, the enemy must yield his position.

A front attack by infantry alone upon a defensive line has little chance of success; obstacles and defensive strength should first be crushed by artillery, posted if possible for oblique or enfilade fire. "After a defensive army has developed its strength, and the weak parts of its line have been ascertained, a powerful reserve artillery will have little difficulty in bringing about a preponderating cross or enfilade fire upon an exposed flank already engaged in front, or upon one or more points of the defensive line, that will inevitably cause disaster." The advance of infantry following this, should be continually supported and covered by the artillery; it should be prepared to advance at once to the front, and if necessary, it should push unhesitatingly into the zone of infantry fire to complete its work; for this is the critical moment of attack with modern fire arms, and any risk must be assumed. But this hazard is not so great as it may appear, if the enemy's infantry are well engaged by that of the attack.

Conditions of ground may favor or oppose long lines of guns, and while larger and quicker results may be derived from massing artillery, this should not always be done. They should not be massed at the expense of mobility and the number should not be beyond what may be well managed. Artillery arranged in groups of four batteries 3,000 yards apart along a line, may be more effective than a larger grouping; in strengthening a line by cross-fire, or for a heavy converging fire. There is danger in stripping a long battle front of artillery for the sake of massing. A long line of artillery should not be formed at the head of a marching column, feebly supported, and much in advance

of the main body, as it might be captured by an adroit movement of the enemy's cavalry.

It is highly advantageous to develope and maintain a superiority of fire from the first. "To push forward artillery, to engage it early in the action; then to mass it and close to short range, whenever practicable, was an essential feature of German tactics in her war with France." As the superiority of rifled guns is, in great range and accuracy, it naturally enters into action first and continues longest. And that it be given every opportunity it should be placed well forward in the column of march, especially a few light batteries to harass the enemy and cover the formation. That this is a proper disposition will be seen from the fact that "To form an infantry division of twelve battalions, six batteries and a brigade of cavalry, occupies from sixty to eighty minutes." The greater range of artillery permits it to support infantry, and yet remain within the second line, so that special supports will be less required. "While artillery can defend itself against a front of infantry, yet skirmishers availing themselves of folds in the ground, may approach and defeat it;" there are necessary, therefore, in advanced positions, infantry, or dismounted cavalry supports. As the breech-loader has an effective range up to 1,200 or even 1,500 yards, artillery should when practicable be kept without this effective infantry zone.

Range finders are indispensable for destructive effect: Telescopic sights should be used and the range carefully preserved. Batteries should change ground as little as possible, for in this, time is consumed, and the range is lost. The range should be regulated by change of elevation as far as is possible. Wherever marching columns of an army are so far separated as to be liable to attack, each should be complete in artillery, cavalry, and all the means of defense. The greater employment than formerly of artillery, and the greater range of small arms will bring about greater loss in horses and men, and provision must be made to supply these losses.

INFANTRY.

Assuming the zone of aimed rifle fire as 1,200 yards broad; and the rapidity of fire and effect of the breech-loader as five times greater than the muzzle-loader; a line of attack in double rank, would never reach the enemy's line in passing through this zone. It would ultimately be destroyed, or driven back, probably the latter, since the boldest troops after a certain percentage of loss, will falter, unless success appears fairly within their reach:—and retreat through such a zone inflicts a greater loss than the advance. The infantry fighting of the future, therefore, to be successful, must be in extended order; the first line of attack or fighting line *consisting* of skirmishers, instead of being as formerly *covered* by skirmishers.

Since 1867, the lateral space of foot soldiers has been taken at two feet. Recent experiments have demonstrated that the maximum effect of the breech-loader is obtained by single rank formation of a man to a yard.

The front of a skirmish line should at least equal a front in single or double rank, as more protection against converging fire is obtained when the front of attack equals the front of defense; besides at the supreme crisis of attack, it may be important that the skirmish line should equal in numbers a single rank to inspire the confidence of shoulder to shoulder formation.

It is necessary to divide the battalion into an active line, a supporting line, and a reserve, or main body, under one command that it may be provided against sudden emergencies, which might culminate before the second reserve line could come up. The fighting spaces therefore will usually exceed one yard. As prescribed by the Prussians they are 2.1 metres, and by the Italians 1.5 metres. In table "K," are indicated deployments from double and from single rank, giving four and six feet respectively per skirmisher. The first line embraces the skirmishers, supports and main body; since upon all these immediately depends its success.

In the "First case," the skirmish line is at the outset deemed to contain a "sufficient number" of fighting men and it is the duty of the supports to feed it constantly up to that number. In the "Second case," it is judged best to have a moderate fire at first, but increasing in intensity with the necessities of the attack; the line being filled to closer intervals as may be required. Of course the loss is less with the increased interval. But in each case there is supposed to be a *sufficient number* of men for the work. "A line should never be strengthened *almost*, but *quite* up to a *sufficient* number; and it is better to have more than *less* men than are required." These cases are intended to illustrate in a general way the proposed methods of open order fighting, imposed by modern fire arms. They give the extent of the battle front, and the number of men per running yard in five army corps, from single and double rank deployments. The "supports" and "reinforce" line should be deployed; but the supporting companies may be either grouped in small columns, or formed in single rank line, depending upon the shelter afforded; efficient support and feeding to full strength the skirmish line, being the main object. It will be at once seen that extended order, is only another form of the two deep line, long the successful order of modern fighting

The breech-loader enables troops to safely assume the open order, since its aimed fire is five times faster, and five times as effective as that of the muzzle-loader. Hence one man is now in all respects the equal or superior of four formerly, in the power of fire and may therefore take the space of four.

Formerly the skirmishers attack preceded the general attack, to harass the enemy and exhaust his fire; now the skirmish line is the attacking line; but it should be a closer line than formerly, and kept up to the maximum.

The tactical company unit being 84 men, if the limit of clearness of the voice be taken at 200 yards, Captains in the

skirmish line in the "first case,,' would be at 56 yards, and in the "second case," at 84 yards from the flanks of their companies; quite near enough for full control and command, if they be equal to the difficulties of command—now greatly increased; seizing cover, advancing at opportune moments, filling vacancies from supports,—all requiring hardy courage and cool judgment. It will be observed that the ranks of the skirmishing companies are filled from others in rear, and to avoid this inter-mingling, it has been urged that each company should have its own supports and reserve. But were this done, there would be no certainty that the support and reserve of each company would, when wanted, be in rear of its skirmishing front. Besides the mixing up of companies, in extended advancing lines is inevitable, whatever the formation. The English troops at the Alma, and in the Peninsular, in line advances; the Germans and French in '70 advancing in column and dissolved into lines of skirmishers; and when reinforced by columns these in turn extending and everywhere inter-mingling attest this. It is no great evil. Besides, in the new order of fighting, where the varieties of cover may demand first a line, then a grouping, breaking and extending, rushing and stopping, now here, now there, cannot hope, nor would it be useful, to maintain the regularity of a line. In action good officers can command any men in their front; and good troops will obey any officer prepared to fitly direct them. The breech-loader does not entail less order, but it may demand more training and better knowledge. But it is better to avoid mingling *battalions;* therefore the shooting line with its supports and main body should be of the same battalion; this has the further advantage, of uniting under one commander these three parts. The reserve or second line, being the third battalion of the brigade. Men from the supporting line, should move directly to the gaps in the shooting line. Lateral movements or closing in, to the right or left, lose time, diminish fire, and compel files to abandon positions gained.

It will be sometimes better that supports be divided into small groups for control and shelter. They must never fire, and never advance until ordered; theirs is a supporting, not a firing line. The main body and brigade reserves may be in lines, or in small columns of little depth; in the latter the reserves would probably suffer less from artillery fire. All troops in columns, in reserve, should be doubled on the centre for more rapid deployment. The line next the active line must be near enough to support. If too near it would suffer unnecessarily. "The shooting line should draw the enemy's fire; if so, the ground behind, swept by bullets at the lowest trajectory, aimed fire, would not exceed 100 yards. The supports should therefore be from about 100 to 200 yards distant from the firing line." The main body is at first, from 500 to 700 yards from the firing line; or about 2,100 yards from that of the enemy; always near enough to reach the firing line before the enemy could do so. If a line is interpolated between the supports and main body, as in the "second case" it should be about half way between these two and at least 100 yards from the former. When the moment comes for deployment into skirmish order of the main body, it should be done by the files swinging from the centre into their intervals, and not by any order of fours, or other prescribed number of separating units, consuming time and creating confusion.

THE ATTACK.

The difficulty of carrying defensive intrenched lines by direct attack was demonstrated at Plevna. The Turks had little time to prepare defenses, and but 80 pieces of artillery to oppose 300 of the attack. "The result showed it to be a days work for a battery to wound a Turk." Loftcha, Kacelevo, and Shipka were further illustrations of the same thing. "Indeed the direct fire of field guns against earthworks, avails little except at short ranges. At St. Privat, 300 guns were concentrated on the defenders who nevertheless repulsed the Prussians with great slaughter." Oblique

and enfilade fire are far more searching and efficacious, and every effort should be made to secure positions for artillery giving these advantages. Equally barren in results is artillery firing at very long range, at bodies of troops in properly disposed formations, or at the enemy's artillery. Hence in the attack, artillery should be advanced from the limit of 3,000 yards, to, when necessary, the limit of effective rifle firing; and, in emergency, should even enter this zone.

Though the increased defensive power of troops in position renders the front attack so hazardous, yet it will rarely happen that the front of a defensive line will not present irregularities and cover, favorable to partial flank attacks, which united may make a front attack successful. "Artillery must be posted to keep down the fire of the shooting line of the defense; and that the guns of the latter may not prevent this, they should also be engaged by the artillery of the assailants and overwhelmed." This preliminary use of artillery is a necessity, and the attack cannot afford to neglect it, their batteries taking positions for oblique, enfilade fire and cross-fire.

The defending infantry will instinctively fire on the assailing infantry, receiving their fire and that of the artillery, and the demoralizing effect of this double fire, augments the power of the attack. The assailant's infantry should deploy at 3,000 yards from the enemy, a portion of the artillery advancing with it to within 1,200 or 1,500 yards, and the remainder firing over the infantry; or, posted as already indicated, at not over 2,000 or 2,500 yards. Artillery should advance by alternation of batteries or groups of batteries to secure continuous fire.

When within 600 or 700 yards of the enemy, the supports advance to the firing line, the main body closes up, prepares to press to the front, and deployes: and the second line advances to easy supporting distance. When the shooting line is within 250 yards of the enemy, the main

body should not be more than that distance in rear of it. "A hundred yards nearer and the success of the attack is assured; the main body rushes to the front and mingling with the firing line and the supports overwhelm the enemy's line. The reserve follows quickly and holds the ground while the main body pours its fire upon the retreating line of the enemy." For many reasons the forward movement of the shooting line and supports, until the final rush, should be at a run, and by alternate companies for about fifty yards at a time, or from one point of shelter, or fold of the ground to another if not too distant; the officer leading: the men arriving lie down, or kneel and open a rapid carefully aimed fire. The decisive and the salient points of the enemy's line invite partial flank attacks along his front; and average ground will always afford shelter to small columns, and to lines of small groups, here extended and there united, and never a sufficient mark for artillery fire. Such points besides being salient are often disconnected as hamlets, woods, farm building, and rough ground affording unusual shelter. A gradual advance and a final extension around the flanks of such exposed parts of lines, if properly supported by artillery, will compel them to yield.

Of course, all this presupposes superior forces of artillery and infantry, otherwise a front attack, at all times hazardous, is hopeless. Flank attacks are preferable where forces and circumstances permit. The front of the enemy, in this case, should be so well engaged as to occupy him, and hold him fast in position; then a few hundred men with breech-loaders, opening on his flank or rear, will decide the rest. For the defense cannot extend beyond a certain number of men per yard. This done, the effect of numbers determines the issue. Modern weapons by their quickened fire, and quick decisions of contests of fire, give a greater value than formerly to superiority of numbers other things equal. And with anything like equality of skill and discipline,

future battles will not be won by greatly inferior numbers. As all evolutions or lateral movements of closing, or extending intervals, are a loss of time, a suspension of fire, and are now far more perilous on the field; the resolution of columns of march, of corps, or divisions, into lines of battle, should be with the most careful regard to intervals. Brigades and battalions in moving to their places in line should remain in lines of small columns to the latest moment, the better to preserve their line of advance and their proper intervals; for the best troops cannot maintain with regularity long marching lines. In future battles while advantages of ground to the defense are of great importance; yet its capture, or the seizure of dominant points of the enemy's line, will extend the effect of such success of the assailants further, and more rapidly toward the flanks of the defense, both morally, and in disastrous fire from such positions, than with short range arms.

Since then, formation of firing lines of *two, close ranks*, are, with breech loaders suicidal, the conclusions forced upon us are that attacks must be in extended order. Infantry formations of attack will require a largely extended front; and infantry on the defensive must conform to this by corresponding extensions.

These extensions are admissable from the increased power of the breech-loader of artillery; and they are *necessary*, inasmuch as a single rank, with the breech-loader, of a man to a yard gives the maximum effect of rifle fire. Open lines at close quarters; small columns of closed lines at longer ranges; and no body of troops, small or large, without its reserve up to divisions and army corps; instead of two lines and a reserve as formerly are coming features. Whether there should be a special army reserve beyond the division and corps reserves will depend on circumstances as to whether an attack, a counter-attack, or a defense of an obviously weak portion of a line be required. But ordinarily a large reserve of an army in

line of battle, even if near the centre would not reach the flanks in time for service.

In their general form the foregoing conclusions, and tactical formations are the official deductions and results of the lessons of the war of 1871 in Prussia, Italy and Russia, and are urged by the foremost military writers of England.

THE DEFENSE.

Fighting in extended order is not only forced upon the defense by the attack, but that order is the most advantageous for fighting, and imposes less loss. He must have his reserves of brigades, divisions and corps, to move the instant the point of attack is made manifest, as well as to be ready to assume, at any moment, the offensive, for a strictly defensive battle is never won.

The attack, through superiority of numbers, may inclose the defense by an encompassing line, subjecting him to a converging or cross fire. But though the fire of the defense is divergent, his line is in position and sheltered, and his fire is more effective. Every advantage should therefore be taken of favorable points and positions for defense, by posting small bodies for counter attack, and for driving back the assailants. "At weak points reserves should be stationed to sustain the firing lines and their supports; and larger reserves should be placed on the flanks. Since advancing lines of attack will naturally seek ravines, points of woods, rough ground and low places, these should be carefully guarded. Gaps in the assailants lines should be at once taken advantage of for partial counter flank attacks." Rapid and effective fire maintained at all points, and especially when the enemy is preparing for the final assault, and his foremost line filled with men; and should his fire indicate failing ammunition, or faltering, he should be vigorously pressed. Ammunition may be exhausted on either side at particular points of lines hotly engaged, and for this reason neither attack nor defense should discard

the bayonet, it should always be at hand for final use. The firing line must be thickly supported wherever most threatened; and reserves must instantly drive out troops who have obtained a foothold within the defensive line. The strongest defensive ground is that affording an uninterrupted sweep for artillery and breech-loaders, with no refuge ground within their destructive range. This is a a peculiar feature of defensive power belonging exclusively to modern fire.

ATTACK AND DEFENSE.

The great range and accuracy of modern artillery have given greater importance to its site on the field. On elevated ground in rear of infantry, the advance of the latter is supported into the zone of infantry fire of the defense, and almost up to the final moment of assault. In this position there is avoided the extension of the attacking front by the intervals which the artillery would otherwise occupy. And this is an important consideration since twelve batteries in line require a mile front.

Napoleon first engaged and developed the strength of the enemy's line of battle then assembled great batteries to crush the way for superior forces of infantry and cavalry, which he concentrated to overwhelm decisive points. Now a preliminary great artillery duel is an essential feature of all attack. To this end more artillery must be attached to the advance guard, and the divisional artillery be placed near the head of the column of march. Artillery will usually be massed at the beginning of the battle at such points as it is expedient to attack. Though a converging fire may be obtained by grouping batteries along the line of attack, massing secures unity of purpose and unity of command. The artillery of the defense must be distributed for use at any point, and can rarely be massed, unless there is a large reserve of guns.

"It will be observed that the immense increase in the proportion of artillery required and brought on to the field

at the beginning of an engagement is a notable feature of modern change in warfare. And the assailant who fails in the prefatory battle of artillery has small chance of gaining the day."

As the single rank is the easiest of extension, it should be the habitual formation of the first line of battle, which it will be remembered, we have designated as including the shooting line, the supports, and the main body.

Especially should our infantry tactics be altered to conform to the condition of modern fire, and altered formations for battle. At present they admit of changes from single to double rank, by but one flank; skirmishing order can be taken only from a solid front of four men; and the prescribed methods of skirmishing are wholly unsuited to the modern shooting and supporting lines. *Now* the fighting line of the battle is the skirmishing line; while *our* tactics contemplate that the skirmish line should cover the attack of fighting lines in rear. All movements whatever of Upton's system are based on a unit of four men front, which may be entirely broken up at the first fire of the enemy. It prescribes the filling of vacancies in the front from the rear rank to preserve this unit of four. How is this possible from the single rank formation, the only formation suitable to the first line of battle? But besides this, front and rear rank distinctions, may now be laid aside, as no longer advantageous or even useful. The division of a company into platoons, and of platoons into sections, and if requisite these last into half sections,—the division in all cases being where most convenient,—may profitably replace orders of fours, for drill and practice, as well as for battle. Such divisions are always arbitrary, and independent of numbers, therefore losses in battle will not disturb them, since exact uniformity is not essential, as in order of fours. No system of tactics should parcel out a company into exact units of command; otherwise the loss of officers, or non-commissioned officers, disturbs the whole control, and for

every fatal shot the command must be rearranged; otherwise the symmetry and the system must be abandoned. Modern tactics should be as simple as possible, consistent with great mobility; and ours would gain much by the exclusion of movements no longer useful.

Napoleon said that a nation should change its tactics every ten years. They certainly should be modified to suit the development of the power of arms, and as often as necessary. They are now greatly encumbered by movements for massing belonging to shock tactics; and by flank movements along an enemy's front.

Manœuvering under fire has now become very hazardous if not impossible. Troops engaged can now do little more than advance and retire. Formations and lateral movements are to be avoided. Plainly, long advances in line or column under fire, are out of the question; and lines of battle must be formed at greater distances. Equally impossible are movements by the flank in the presence of the enemy, of the nature of those of Frederick, at the battles of Leuthen and Kolin. In encompassing lines of attack crotchets formed by the defensive line would not protect it from reverse fire. With a superior force, and a vigorous attack on the enemy's front, the advantages of an attack on the extremities of his line are greatly increased with modern arms. Greater precautions than formerly, are now necessary to be taken in pushing troops into hazardous positions, that they be strongly supported. Movements of attack must be avoided, which depend for success upon withdrawal of troops under fire from the enemy's front. Troops in retreat now suffer far more than before,—conspicuously cavalry.

The defence must guard against greater liability to flank attacks; and as the increased power of the breech-loader enables a small body of men to hold longer a strong position, strong parts of his line may be depleted somewhat to strengthen weaker points;—provided that it forms a chord to the enemy's arc of attack. On the offensive, strong parts of a line may be more safely trusted with a smaller

force, while a flank of the enemy is being turned. "In general, both on the offensive and defensive, it will commonly be more expedient than before, to run strategical risks, to secure tactical advantages." There is not only immense moral power in the offensive, but the increased range and accuracy of fire give *to the attack* a decided gain, in the selection of ground for his operations. In intrenched lines; in fronts of uninterrupted fire over wide levels; and in the strength of troops in position partially sheltered, whether natural or artificial cover, *the defense* has gained vastly in power of resistance. The tactical power of modern arms eliminates very largely the element of "chances of battle," and will permit the forecast very closely of results, both of battles and wars, certain elements of the problem, as to numbers and resources being given.

Difficulties of attack will more frequently compel the movements of troops at night into positions near the enemy's lines, if not of night attacks, particularly in the case of intrenched lines. In such cases the power of the defense will be greatly weakened if the assailants reach the enemy in good form. The moon-light attack on Kars is an illustration of this. The Turks with a small force losing only ten per cent. in its capture; while the Russians, supported by 100 guns, in vain attempted to retake it on the succeeding day.

Provision should be made to keep the first line, without possible failure, supplied with ammunition. The men should take 100 rounds into battle, and a reserve on pack-horses, or man-carts. The latter should be bullet proof and protected by bullet proof shields. These should follow the first line into the fight. The Turks in their war with Russia, had pack-horses led in rear of the shooting line of each battalion, and with but little loss. Troops attacking at special or decisive points, or holding a vital portion of a line, will have the hardest fighting, and they should not be emasculated by a want of ammunition.

The difficulties of command are greater with breech-loaders. Fighting is more individualized, from the lowest to the highest unit of command. More is left to the judgment of the commanding officer of each, from the company to the corps commander, and more is required of each. The fate of battles depends more on the courage and capacity of individuals; and the difficulty is greater of holding men in hand, and maintaining a close directing power. The General may order the attack, but the careful disposition of troops to the ground, and their forcible use to a common purpose, must be left to company, to field, and to subordinate general officers. Upon skill in handling units of command, will depend, far more than ever success. A want of knowledge, or of determination, at a critical moment may cost many lives and bring irretrievable disaster. Obviously for the successful execution of his new part the officer requires the most thoughtful preparation. The field telegraph may do much to enable the General to unite in one direction, the various energies of and to supplement the varying necessities of a long battle front. To this end it is an indispensable aid, but it can never equal personal supervision, and therefore far more must be left to division and to corps commanders. In short, the essence of the modern system is to develope individuality, and to make officers and men thinkers as well as fighters.

By lines of rail and rivers, and by the telegraph, the operations of war are brought into close and rapid, even strained connection. Distant campaigns formerly impossible are now wholly practicable. Whatever the extent of the theatre of war, results are quickly integrated, and the ultimate effect is the same as though the field of movement was far more contracted. The mechanism of war is more delicate, and a force anywhere applied is everywhere quickly felt, and because of this state of absolute tension of parts, there should nowhere be permitted manipulations, by any but master hands.

APPENDIX.

EXTRACTS FROM THE MINUTES OF THE EXECUTIVE COUNCIL, M. S. I.

June 18th, 1881.

* * * * * * * *

General Abbot offered the following resolution which was read and unanimously adopted :

"*Resolved*, That the prize essay for the current year be omitted, and that the subject selected at the last meeting of the Council for this year be adopted, as the subject for the prize essay for the ensuing year, viz :

"The Important Improvements in the Art of War during the past twenty years and their probable effect on future military operations.

* * * * * * * *

January 3d, 1882.

* * * * * * * *

On motion of General Gibson it was

Resolved, That the Board of Award on the Prize Essay for the year 1882 be composed as follows :

General GEORGE B. MCCLELLAN,
General IRWIN MCDOWELL,
General JAMES B. FRY.

* * * * * * * *

September 21st, 1882.

* * * * * * * *

The following report received from the Board of Award on Prize Essay for 1882 was read by the Assistant Secretary.

New York City, June 20th, 1882.

To MAJOR GENERAL W. S. HANCOCK,
President of the Military Service Institution,
Governor's Island, New York City.

GENERAL :

Having been chosen by the Executive Council of the Military Service Institution as members of the Board of Award for the prize essay for 1882 on the subject of "The important improvements in the art of war during the past twenty years, and their probable effect on future military operations," we have the honor to report that we have performed the duty confided to us. We found all the essays submitted to us—five in number—interesting and instructive. We regard those

signed respectively "Aleph," "Nemo" and "Trent" as especially meritorious, and as deserving to stand in the order named. The last of these is an able paper but it is not so rich in examples and statistics as the others. The first two appear to us to be of about equal merit in their treatment of the general subject, but the paper signed "Aleph" being most thoroughly worked out in detail, we are of opinion that it is entitled to the prize.

We congratulate the Institution on being able to secure such contributions as the essays we have examined, and venture the opinion that their publication and distribution will be of greater service to the regular army, and also to the volunteers and militia on whose patriotism and readiness for military duty the nation depends in great emergencies.

With the highest respect, your obedient servants,

(*Signed*) GEO. B. MCCLELLAN,
JAMES B. FRY.

Presidio, San Francisco, Cal.,
June 13th, 1882.

GENERAL T. F. RODENBOUGH,
Secretary Military Service Institute of the U. S.
Governor's Island, New York, N. Y.

GENERAL:

I have duly examined the five essays submitted by competition for the prize offered by the Institute for the current year and, as one of the Board of Award, my vote for first in order of merit is for the essay signed "Aleph." And my vote for the second in order of merit is for the essay signed "Nemo."

I had intended to accompany this vote with some extended remarks, but circumstances have prevented.

I am, General, with great respect,
Yours sincerely,
(*Signed*) IRWIN MCDOWELL, M. G.

The letter bearing the mark "Aleph" was then opened and Lieut.-Col. Henry M. Lazelle, U. S. Army was announced as the successful competitor.

The letters bearing the marks "Nemo" and "Trent" were then opened and the names announced as follows:

Lieutenant F. V. Greene, Corps of Engineers, U. S. A.
General W. Merritt, Colonel 5th Cavalry, U. S. A.

* * * * * * * *

A True Copy,
H. O. PERLEY, *Asst. Secretary.*

THE USE, DEVELOPMENT AND INFLUENCE OF THE ELECTRIC TELEGRAPH IN WARFARE.

BY SECOND LIEUTENANT F. C. GRUGAN,
SECOND U. S. ARTILLERY.

IT has been said that a close connection may be traced between the operations of war and the different telegraphic systems that have been devised from time to time, and that, in fact, more than one of these systems has originated solely for the purpose of facilitating military communication. The Torres Vedras signal system organized by the English in 1809, is cited as an example, and also Chappe's aerial telegraph with Brequet's improvements, first constructed in France between Paris and Lille in 1793, subsequently extended to Calais, Strasburg, Toulon, Bayonne and Brest, and by means of which Paris received the news of Napoleon's victories.

This connection of telegraphy with the operations of war, lends to its historical features an interest for the military profession which is increased by the certainty that in future wars its employment will be not only extensive but indispensable.

But in admitting its necessity only one step forward has been taken. The question of organization and material has not yet been definitely settled, and there are still very decided differences of opinion regarding the extent to which the telegraph, and especially the electric telegraph can be used in war.

The system of battle tactics adopted in Europe is one that not only recognizes a certain independence of action on the part of subordinate officers, but even requires them in critical moments to rely solely upon their own judgment, and as there is then no time to ask for orders, and no one who knows as well as the officer immediately present what action the moment demands, is it not allowable to ask this question: on the actual field of battle, and in the front lines, can the electric telegraph be of any service?

This is the problem they are trying to solve in Europe. In the United States during the war of the rebellion, the telegraph on more than one occasion rendered valuable service on the field of battle. That may have

solved the question for twenty years ago. But to-day the circumstances are not the same. There is now greater rapidity of action. This was one of the marked characteristics of the Franco–Prussian war.

Of the wars that have occurred during the past twenty-seven years more than one has led to a remodelling of the military telegraph organizations, and the changes which have taken place must be ascribed less to new scientific discoveries than to the belief that the best means at hand had not been properly applied.

For example: during the autumn manœuvres of the English Army in 1872, field telegraph lines were constructed in a comparatively level and open country, both insulated wire lying on the ground and naked wire suspended from telegraph lances being used. The cable, or insulated wire was out of order about one-fourth the time that these manœuvres lasted, the suspended wire only $\frac{1}{40}$th.

In 1876, the Japanese Government obtained from Berlin a complete telegraph train of Prussian design. I have seen it stated, though I can not now give the author, that this train, suitable for the level plains of Central Europe, was found entirely unserviceable in Japan, where the country is mountainous, where good roads are few in number, and where ox carts and pack animals are the general means of transportation.

This question of topography must certainly have great weight in determining what the material of the field telegraphs shall consist of, and how it shall be carried, and an idea may be formed of the difficulties to be overcome in the sole matter of transportation, by the estimate that in Napoleon's Jena campaign of 1806, short as it was, it would have required 794 wagons to transport sufficient material to have maintained air line telegraphic communication.

It is proposed in this article to give some of the main facts of interest relating to the use, development and influence of the electric telegraph in military operations. These facts have been obtained from and are only to be found in foreign publications, and the preparation of this article became almost entirely a work of compilation.

A list is appended of the authorities consulted. Buchholtz's Kriegs-Telegraphie (1877), and Von Fischer-Treuenfeld's most excellent and exhaustive work (Kriegs-Telegraphie, 1879), constitute the principal sources from which information has been obtained.

In 1839, Major von Etzel, then in charge of optical signaling in the Prussian Army, suggested to the war department the possibility of employing the electric telegraph. In 1844 a board of officers was convened to consider the subject, and several years later the necessary material was supplied, and the line was built. No further information relating to this experiment is at hand.

In 1853, during the military manœuvres at the camp of Olmütz, the

Austrian Army employed men to hold light lances upon which the wire was suspended thus constituting a movable telegraph line. The results of this experiment were not considered satisfactory.

The first practical application of the electric telegraph to military purposes was made by the allied armies during the siege of Sebastopol, 1854-1855, not, it is said, for any tactical purpose, but simply to afford a convenient method of communication between the several headquarters. The lines partook of the character of permanent lines, and were not intended to follow the movements of the army.

In Prussia, from 1854 to 1856, the subject of military telegraphs was again taken up, and their proposed sphere of action defined as follows: 1st. To connect the general headquarters, or headquarters of a division, or other large body of troops, by telegraph lines with the permanent lines of the country, and thereby with the capital. 2d. To connect the headquarters of a division with the general headquarters, or to connect the several division at headquarters with each other, either directly, or by means of the permanent lines of the State.

It was not contemplated that the lines should follow the movements of troops, nor that they should accompany them on the field of battle.

The results of experiments made were so satisfactory that, in 1866, the government organized as a permanent branch of the military service, the field telegraph which eight years later accompanied her army in the war with Denmark. This appears to be the first recognition by any government of the telegraph as a permanent part of the military establishment. This organization, however, did not constitute a special military corps, but was assigned to the pioneer battalion of the guards, its station duties, that is the management of the telegraph instruments and batteries, being performed by civilian employees of the State telegraph lines.

In 1857 the great Indian mutiny broke out, and field telegraph lines were constructed connecting the advancing columns of troops with the Governor General at the seat of government in Calcutta. Naked iron wire was used, suspended from trees or bamboo poles, or simply laid on the ground without insulation, the dryness of the soil and of the atmosphere allowing these non-insulated wires to be worked throughout the length of one hundred miles. In rainy weather transmission frequently ceased entirely. The lines rendered valuable service and attracted much attention in military circles.

In 1857 Marshal Randon employed the electric telegraph in the French operations in Algiers, the work being performed by civilian telegraphers, the wire suspended from trees. It is said that the headquarters of the army in the field were kept connected with the town of Algiers.

This same year the English established at Chatham a military telegraph school for the instruction of men detailed from the corps of engineers.

In 1859 Spain organized and employed in the Morocco war a field telegraph designed for mountain and out-post service, and which deserves special mention. Von Fischer-Treuenfeld says that after an experience of twenty years by the great armies of the world, the latest and most approved system devised to accompany troops, has retained the principles upon which this early Spanish organization was based, and which in the Morocco war not only connected the army with its base, but even kept advanced posts in communication with the commanding general. The line consisted of insulated wire coiled on reels transported on pack animals. Morse printing registers enclosed in specially designed boxes, were carried by pack animals or by soldiers. It is this system which exists at the present time in the Spanish army, and has been brought to a high state of efficiency.

In 1859, in the Franco-Austrian war in Italy, the military telegraph service of the French army was conducted by civilian employees of the State telegraphs, supplement by peasant labor and carts from the surrounding country. The peasant labor was found particularly unsatisfactory, and before the close of the war the necessity was generally recognized for a military *personnel* and improved material. It was also during this campaign that a further step in advance was taken, for we find that not only was electrical communication with France constantly maintained, but that orders were transmitted by the field telegraph from the general headquarters to the front and flanks of the French army.

In 1861 the Italian army obtained excellent results with the system which provided for maintaining communication with the rear as the troops advanced. Two army corps starting from different points and marching on Ancona, but separated from each other by the Apennine mountains, were kept connected, it is stated, by lines which were built by and kept pace with the troops. This appears to be the first successful carrying out of this new feature of military telegraphy. A copper wire was used, suspended from insulators attached to poles. In front of Ancona the army, the fleet, the general headquarters and the flanks of the army were connected with each other and with the permanent lines of the country by telegraph lines and semaphores. At Gaëta the same feat was accomplished.

In the United States in 1861, upon the breaking out of hostilities between the North and South, the electric lines were considered indispensible, and their employment was on a much more extended scale than had ever before been attempted. To the signal corps of the army was originally assigned the duty of providing telegraphic communication. Beardslee's magneto-electric instruments were used by the corps, which enabled the voltaic batteries to be dispensed with for short distances, and which also called for less skill on the part of the operators. This system,

however, did not work satisfactorily, and in November, 1863, the Secretary of War directed Colonel Anson Stager to assume the direction of the electric telegraph service, the *personnel* of which was reorganized, the magneto-electric instruments displaced by Morse sounders, and the working capabilities of the corps greatly increased. Until the close of the war General Stager remained at the head of an organization the efficiency of which has not been surpassed, and it is recognized that the services rendered by the telegraph during the war were of inestimable value, and that the proficiency attained in erecting and working the lines, and the suitability of the field material, enabled communication to be established whenever deemed necessary. Over fifteen thousand miles of military telegraph—land, submarine and field lines—were built for army purposes. Many miles of these lines were built under the fire of the enemy. Many members of the organization lost their lives, some in battle, more from disease brought on by exposure in the line of duty, and many were wounded. When civilian employees could not be obtained in sufficient numbers, soldiers were detailed from the ranks and instructed in the duties which they were called upon to perform. General Sherman says in his "Memoires": "The value of the magnetic telegraph in war can not be exaggerated, as was illustrated by the perfect concert of action between the armies in Virginia and in Georgia, in all 1864. Hardly a day intervened when General Grant did not know the exact state of facts with me, more than fifteen hundred miles off, as the wires ran."

It does not fall within the scope of this article to give in detail the workings of the telegraphic organization. Such facts as are stated have been obtained from a work just published, called: "The Military Telegraph during the Civil War in the United States," by W. R. Plum, and in its two volumes will be found a detailed history of the service of which the author was a member.

It is claimed that the electric telegraph was repeatedly used on the field of battle during the Peninsular Campaign, in 1862, and again at the battle of Fredericksburg, in 1863, and this for the first time in the history of war.

During the siege of Charleston communication with the troops in the trenches and in reserve was kept up by means of field lines pushed forward and maintained so close to the rifle pits of the enemy that the wires were frequently cut by their balls.

During the march of the Army of the Potomac southward in 1864, though every corps moved daily yet the headquarters of each was generally in communication every night with the commanding general of the army.

In his annual report for the year ending June 30th, 1864, Major Eckert, one of the chief officers of the telegraph, said: "A telegraph line was built on the south side of the James River, from City Point to Swan's

Point, there connecting with a submarine cable to Jamestown Island; but owing to interruptions by guerrillas, this line was not worked successfully until June 24th, at which time a sufficient force was stationed along the lines to protect it from guerrilla raids. From City Point, lines were built to General Meade's headquarters, two and one-half miles south-east of Petersburg, and to General Butler's headquarters at Point of Rock, on the Appomattox, crossing at that place with submarine cables. Lines were also constructed to all corps headquarters and to our advance works. During the operations at Spottsylvania, on the North Anna, at Cold Harbor, in the march from Cold Harbor to City Point, and in the battles in front of Petersburg in June, the field telegraph lines were worked with great success, and invaluable aid was thus rendered to the Government. General Grant and General Meade were kept in almost constant communication with each other and with the different corps of the army. * * * They (the field telegraph lines) have worked many times in the face of the enemy, exposed to fire, without shelter, have been kept up day and night whenever required, and have had innumerable difficulties which can never be known to but few."

And again in Mr. Plum's work is found the following from the same officer, June 15th, 1864:

"My field telegraph continues to work like a charm. Instead of letting down, it has improved every day since we left Brandy Station, and is complimented by all. Doren has *built and taken down* an average of twenty-four miles daily. Most of his work has been after night, and under very great disadvantages. *All corps* headquarters and many brigades have been in constant connection with Generals Grant's and Meade's headquarters, during every *engagement*. Also every reconnoissance that has been made in force has had telegraphic connection with headquarters. Last, but not least, connection has been kept up while on the march. * * * We have lost thus far one man killed and one wounded (builders), ten horses and four mules killed. In Longstreet's attack upon Hancock after leaving Spottsylvania, we lost our battery wagon. A solid shot struck the running gear, demolishing that portion of it completely. The sections of battery were soon transferred to a common army wagon, and put in working order in less than twenty minutes. Fortunately not a single cup was broken. During this dash we lost seven miles of covered wire in one line, and one mile in another."

In England, in 1862, Captain Bolton devised a system which provided for out-post telegraphs. Morse sounders and a light cable consisting of a copper wire with caoutchouc envelope were proposed.

In Von Fischer-Treuenfeld's work is found an interesting account of the labors of the military telegraphs during the five years war between Paraguay and Brazil (1864–1869), when they were used not only to con-

nect permanent works, but also detachments separated from the main body, and out-posts, and were worked during battles. Shortly after the outbreak of war, President Lopez ordered the civil telegraph service to be transformed into a military telegraph organization, and as Paraguay was cut off from all exterior communication, it became necessary to manufacture within the State the field material required, a material which comprised telegraph instruments, insulators and insulated wire, and later, in 1868, even the paper required for the telegraph service. From April, 1866, to the death of Lopez in March, 1870, the telegraph accompanied at all times the Paraguayan troops, and but few battles were fought in which Lopez did not from his headquarters at the rear transmit orders over the telegraph wires.

During the engagements at Itapiru and Paso la Patria, the telegraph lines worked throughout the battles, the operators being among the last to leave the field. At the battles of Estero Bellaco, 2d and 24th of May, 1866, telegraph lines extended from the general headquarters to all the divisions of the army, and as new positions were taken up, the construction corps followed the troops, always able to connect with Lopez. During the attack on the lines at Curupayty, September 2d, 1866, General Diaz, the Paraguayan Commander, remained throughout the greater portion of the engagement at the telegraph station which overlooked the field and was under the enemy's fire, conducting the battle and communicating by wire with Lopez at Paso la Patria, three miles distant.

Brazil, like Paraguay, possessed no field telegraph when war was proclaimed, and did not, in fact, obtain one until 1867, more than two years after the beginning of hostilities. Even then the amount of material supplied was so limited that the Brazilian field telegraphs were prevented from reaching a development which they would otherwise undoubtedly have attained.

The first supplies received consisted of five portable electro-magnetic instruments of the Siemens pattern, a limited supply of insulated wire, and a specially designed plow for burying the wire. Galvanized iron wire was subsequently received, and pending the arrival of hard rubber insulators, the wire was suspended in notches cut in the poles, or the necks of glass bottles were used. The telegraph employees, officers and soldiers, received sufficient instruction to enable them to build and work the lines, and it is asserted by the chief of the corps, that on more than one occasion the Brazilian army owed its success to the prompt arrival of reinforcements or rations called for and ordered up by means of the telegraph.

At the seige of the Fortress of Humaita, the electric wires were of inestimable value. The movements of the enemy were observed from a well selected station of observation, and Lopez' frequent attempts to force

a way through the Brazilian lines were beaten back only by the rapid concentration of troops at the threatened point, effected by means of the field telegraph lines. It is claimed that cavalry detachments and out-posts at times eight miles from the army were connected by wire with the headquarters ; that the lines followed the advance, and that they were employed on the battle field for tactical purposes.

In Bohemia in 1866, the military telegraph material that accompanied the Prussian armies was found sufficient in quantity but not in quality. Copper wire was used for the suspended lines. The insulated wire known as the Siemens cable, consisted of a three strand twisted copper wire, surrounded by two layers of gutta-percha with an outer covering of hemp yarn, the whole protected by thin copper wrapping. It is thick, very heavy, difficult to reel up and unreel, and was found unsatisfactory. One hundred and thirty-seven miles of wire and cable were carried. None of the lines constructed were longer than ten miles, within which distance it was always possible to reach a permanent line of the country.

The headquarters of the three Prussian armies and of the several corps were kept connected with the headquarters of the King and with Berlin, and for strategical movements the general working of the telegraph organization was not entirely unsatisfactory. But for tactical manœuvres both the material and the *personnel* were unsuitable. The material for the reasons already stated, the *personnel* because the lines could not be constructed and repaired with sufficient rapidity.

Notwithstanding the fact that during the campaign of 1866, the field telegraph had attained only a partial success, it was nevertheless recognized at the close of the war, that for combining military operations where considerable distances separated the troops, the electric telegraph was both a safer and more rapid aid than mounted messengers.

During all these years France was experimenting, but had not adopted any definite military system, and, in fact, she remained up to 1868, the only great military power that had not organized this branch of the service. After the battle of Sadowa, extensive trials were made at the camp of Chalons in connection with the yearly military manœuvres. These trials were continued from the beginning of May to August. The telegraph was divided into field telegraph and mountain telegraph, each having its special equipment. Experiments were also made with out-posts and reconnoissance lines. Cavalry patrols five miles distant were kept connected with the main army, the line keeping up with the troops both in the advance and in the retreat. Fifteen miles of cable was successfully laid, worked and reeled up within twelve hours.

At the termination of these experiments the French Government ordered the formation of a military telegraph organization directed by officers of the General Staff which, already at the commencement of the

Franco-Prussian war, in 1870, appears to have worked in an unsatisfactory manner, and which fell into the hands of the Germans at the capitulation of Metz. The *personnel* was not sufficiently numerous. Napoleon's despatch from Metz, in which he complains that for two days he has received no news from Marshall MacMahon or General de Failly is an eloquent commentary on the working of the French field telegraph.

Their fortress telegraph lines were more successful. Previous to the siege of Paris each of the detached forts around the city was connected with the enceinte and with an adjacent fort, 1st, by wires suspended on poles 2d, by insulated wire buried beneath the surface of the ground ; and 3d, by optical signal lines. The air-lines were soon destroyed by the German artillery fire; the buried lines worked throughout the siege, and the optical lines not being required were seldom used. For securing communication beyond the lines of investment, a cable had been laid in the bed of the Seine river, but, one of the employees of the French State telegraph gave the Germans information which led to its being searched for, found and destroyed. (Kriegs-Telegraphie). In 1874 the matter was again taken up and a system was adopted which entails the working of the stations upon the administration of the State telegraphs, the train service, and the construction, protection and removal of lines being entrusted to the troops. The whole is subject to the War Department and takes part in the yearly military manœuvres.

In the Abyssinian war, in 1868, the English telegraph lines were built from the Red Sea to Magdala, affording direct communication with London. The wires were stretched on bamboo poles obtained from Bombay. At the front the signalling was entirely optical, flags being used during the day, oil or calcium lights at night. The sole object of this line was to connect the army with its base on the coast.

In Germany, from 1867 to 1869, efforts continued to be made towards increasing the efficiency of the militaty telegraphs and the specific duties of the two sections into which the service had been divided, were defined as follows: the "etappan" detachment to follow the army from day to day, keeping headquarters in the field connected with the permanent lines of the country ; the field detachment to maintain communication between army and corps headquarters. About this time the War Department announced the desirability of out-post lines, and in the Autumn manœuvres of 1868, attempts were made to keep the line of out-post supports, reconnoitering detachments and even columns of attack connected with the rear. This first attempt of the Germans to use the telegraph for tactical purposes failed on account of the too great weight of the material, and the want of proper instruction on the part of the men. Therefore, in 1870, at the out-break of the Franco-Prussian war, the German military telegraph system had not been sufficiently developed to permit general tactical application.

The telegraphic manœuvres of 1868 and '69, though disappointing in one particular direction, had, nevertheless, resulted in much good. The troops were familiarized with the service, and were made to see that under certain circumstances the telegraph might contribute to success, as well as to comfort, and, as a consequence, the lines were better guarded throughout the Franco-Prussian war, and, when stations belonging to the enemy were captured by the advance guards, the station batteries and instruments were carefully preserved from destruction and were used by the Prussian Armies. Throughout the war the telegraph frequently rendered efficient service, contributing in a marked manner to the German success. At the seige of Paris the wires were carried up to the advanced lines, and it has been said that without them, this decisive operation could not have been brought to a successful ending, for the lines of investment were forty-six miles in length, with about four thousand men per mile, and the besiegers less numerous than the besieged. At Strasburg the telegraph wires were pushed up to the third parallel, and were of great assistance in directing the Prussian artillery fire. During the three days battle on the Lisaine, when Bourbaki attacked Von Werder, who was covering the siege of Belfort, it was owing to the excellent telegraphic communication which had been established throughout the German army, that the timely arrival of the reserves from the extreme right wing was affected, as also their subsequent return to the right at a critical moment.

During the rapid concentration of the German troops at Sedan, the amount of field material with the army did not permit the construction of a sufficient number of lines.

In 1873 M. Trouvé, in France, proposed a system designed especially for out-posts, and which had been tested during the siege of Paris, and had worked on the field of battle. On account of its great portability and the small force, two or three men, required to work it, it attracted much attention in military circles abroad. The entire apparatus is enclosed in a wooden frame resembling a knapsack, and carried on the soldiers back. A small reel around which the cable is wound fits into the frame, and when the first supply of cable is expended, the empty reel can be removed and a fresh one put in its place. Each reel holds 1,000 metres of wire. The battery is so arranged that when not in use the zinc plate is out of the sulphate of mercury solution, and, consequently, there is no expenditure of battery material. For use the battery cells are inclined and the zinc is thereby plunged into the fluid.

Trouvé has used both a small sounder and a needle instrument about the size of a large watch for transmitting and receiving.

Captain Buchholtz, of the Prussian service, is said to have greatly improved this system of out-post telegraph, and to have made it a success, but the details of the improvement are not at hand.

At the present time throughout Europe, this question of outpost telegraphy is being carefully studied.

In England, immediately after the close of the Franco-Prussian war, the military authorities ordered the field telegraphs to take part in the manœuvres of '72, their sphere of action being defined as follows :

1st. To maintain constant communication between army headquarters and the base.

2nd. To connect each division headquarters with the headquarters of its brigade, either by optical signalling or the electric telegraph.

3rd. To keep corps headquarters connected with the headquarters of the division, and at night with the flanks.

4th. The headquarters of each brigade to provide for communicating with its out-posts by means of optical signals.

The telegraph lines, as previously stated, did not work well, for they were out of order almost one-third of the duration of the manœuvres. The failure is attributed to unsuitable material, to the employment of cable when air lines should have been used. This agrees with the experience had elsewhere, that cable is best suited for mountainous districts with rocky soil, or for woods. For out-post communication, white flags were used during the day, calcium lights at night.

It appears that when the Ashantee war of 1873 broke out, no field telegraph material existed in the English army, and none reached the troops until they had advanced well into the interior of the country, and the necessity for connection with the fleet had been recognized. When the supplies were received they were found both insufficient and unsuitable, but nevertheless, were of service in hastening the termination of the war.

The military system of Spain, previously referred to as having been used during the Morocco war in 1859, was successful at the very outset in securing a firm footing in the military service. In 1868, in the battle of Alcoba, the Spanish commander remained in constant communication with Madrid, and General Prim in repressing the Republican and Carlist insurrections found the field telegraph an indispensable ally.

During the civil war in Spain, in 1873, the "flying telegraphs" were constantly in use, and in defence of Bilboa, in 1874, it was only with the assistance of the electric telegraph, enabling rapid concentration, that the extensive works could be held by the weak garrison of the place. Upon the raising of the siege the field telegraph accompanied the army in its movement to the north, but owing to the occupation of the greater portion of the country by the enemy, it became impossible to maintain a continuous telegraph line, and therefore optical signalling was used to bridge over the interrupted distances. Originally the telegraph service in the Spanish army was performed by employees of the State lines, who received special instructions to prepare them for their war duties. The

government finally decided to adopt a purely military organization. This has been carried into effect, and at the present time two companies constitute the *personnel* of the military telegraphs of the Spanish army, which is divided into mountain and outpost telegraph, and optical signaling.

On the side of the Turks in the late war with Russia, no special field telegraph corps existed, though permanent lines were built for military purposes. A few civilian telegraph employees were assigned to each corps for the purpose of connecting with the general headquarters, but the material was not suitable for field lines, and upon the withdrawal of the troops the lines in the abandoned districts had to be given up, only the station apparatus being removed. On reconnoissances information was invariably sent back by messengers, and not a single attempt appears to have been made to connect an outpost with any headquarters. No tactical application of the telegraph on the Turkish side occurred during the war. Orders, it is true, were telegraphed directing an advance to be made at a special time, or a position to be changed, or a retreat to be made, but such orders were not made to apply to movements during an engagement.

In fact the trouble did not end here, for it appears that the Turks did not possess a signal organization of any kind ; that during the war, except in the Egyptian Corps attached to the Army of the Lom, no such thing existed in the Turkish army as a system for transmitting flag messages.

On the side of Russia all is different. Here the employment of field and even of outpost telegraphs was general throughout the army, and no better illustration to prove their great value need be desired than is furnished during General Lazereff's movement against the army of Mukhtar Pasha, in the Kurukdere Mountains on the 17th of October, 1877. General Lazereff, with twenty-seven battalions, forty guns and six regiments of cavalry, was ordered to march around Mukhtar's right, and passing along his rear, and cutting him from Kars, to place him between his own (Lazereff's) and the Grand Duke's armies, to attack and destroy his force. Mukhtar, becoming aware of his movements, attempted to cut Lazereff off, and for this purpose sent fifteen battalions, subsequently reinforced, to carry out the operation.

Lazereff, after a severe fight on the 13th of October, gained possession of Mount Oghur, a strongly fortified point which connected Mukhtar with Kars. From this place he telegraphed to the Grand Duke over the field telegraph lines, which had been constructed along his entire march, and which had kept pace with the troops, that his position in face of a greatly superior force, required a simultaneous attack by both his own and the Grand Duke's troops.

This dispatch reached the Grand Duke at three o'clock on the morning of the 14th of October. The simultaneous attack that followed led to the destruction of the Turkish army.

Regarding the telegraph line itself, it is said to have been built with rapidity, to have worked during the attack on Mount Oghur and during the subsequent battle. It was guarded by Cossacks, and was not in working order during only two hours, and on it depended the success of the campaign in Armenia.

In 1879 England declared war against the Zulus, but it does not appear that any provision was made at the commencement of the campaign for a field telegraph. This was found to be an error, and it was not until some months after the beginning of the war that the necessary material was sent to Natal. The first supplies were to be transported in wagons. Later additional material was sent out, designed for transport on pack mules, the poles or lances being of two kinds; light iron tubing, or wood in two sections, to be fastened together by wire wrapping during the process of building the line. Naked iron wire was used.

At the commencement of the Afghan campaign, the working of the field telegraph was constantly interfered with by the cutting of the line. Up to October, 1879, the Khyber line, on a total distance of one hundred and eight miles, was cut ninety-eight times, and sixty miles of working wire was carried away and never recovered.

As operations progressed, arrangements were made with the tribes which secured a better guarding of the lines, and the telegraph henceforth worked satisfactorily.

Such are some of the historical facts connected with the use of the electric telegraph for military purposes from its introduction down to the present time.

Turning now to the *personnel* of the military telegraphs as at present organized, a notable difference is found to exist in the manner of its recruitment, and though all civilized governments recognize the necessity for a carefully selected and well instructed corps of employees during military operations, they do not appear to have arrived at any general conclusion as to the source from which the force can be best obtained. In Germany the supervision is entrusted to officers of the engineer corps, the building of the lines to pioneer detachments, the station service to civilian employees of the State telegraphs.

In France the troops are called upon only to guard the lines and to conduct the telegraph trains.

In Austria the lines are built and the train service performed by soldiers, the general management and the station service being in the hands of civilians belonging to the State Administration of telegraphs.

In Belgium, England, Sweden, Spain and Italy the organizations are

purely military, no civilians being employed. This also applies to the Russian "field telegraph."

The question of expense has probably much to do with these different methods of recruitment. But when the nature of electricity is considered; when we recognize the fact that the most minute fault may be disastrous to the working of an entire military line, and may entail serious consequences, the wisdom may at least be questioned of entrusting to a hastily gotten together corps such extremely important work as must in time of war devolve upon the military telegraph, the duties of which require exposure and labor of the most severe kind. The French civilian system does not appear to have been a success. In Spain, where the *personnel* is composed exclusively of soldiers, the field service is said to be well developed, the pack animals following and keeping up with the troops, the material suited to the country.

Though there exists in Europe this difference of opinion as regards the *personnel* of the telegraph organization, there appears to be general unanimity as to its field of action. If war should be declared to-morrow between Germany and France, the headquarters of each army would be connected with the telegraphic net-work of the country, and, consequently, with the seat of government. The field telegraph would connect the divisions with their respective corps, the corps with army headquarters, and whenever desired the brigades with their respective division headquarters. By means of Buchholtz's or Trouvé's out-post system it is proposed to connect with each other or with the rear, such outposts as are of special importance, reconnoitering detachments, or detached bodies occupying advanced positions, and especially the flanks. In siege operations the electric telegraph lines will be brought into increased use.

As regards the extent to which they may be employed on the field of battle, this is a question which still remains to be decided.

In military circles in Europe there generally exists an unwillingness to entrust military messages to any electric system which does not keep an automatic record of the message. It is said that if there be no record of the message as it was sent and as it was received, in other words, if the message be received by sound, it will be often impossible to properly place the responsibility for errors committed, and this objection has led to the devising of telegraphic registers suited to military service.

As regards the telephone, that it will be of service in the field is more than likely, but to what extent is not so easily answered. Siemens, of Berlin, has devised a call apparatus which consists of a tube or mouthpiece, called a "trumpet," which being inserted in the mouth of the telephone, and being blown through, causes the "trumpet" at the distant station to emit a sound sufficienly loud to attract the attention of those who are not far distant from the instrument. This enables the bat-

tery, or electro-magnetic machine used for "calling up," to be dispensed with.

Numerous experiments have already been made with the telephone by the military authorities in Europe. It is more easily used in-doors than in the open air, where strong wind and noise greatly interfere with its successful working.

Though the telephone has still its war record to make, it is, nevertheless, safe to predict, that the interior service of an army in camp will be greatly assisted by its use, and that even on out-post duty it may prove of value.

But in drawing up a plan which will provide for the military communications of an army in the field, ample provision must be made for visual signalling, for there will arise occasions when the electric telegraph can not alone supply the desired connection. Difficult mountain ranges, intervening districts occupied by the enemy, will constitute obstacles which may be easily overcome by means of heliographs, or other long range signalling instruments. Mr. George Davidson, of the United States Coast Survey, upon several occasions saw the Snow Mount heliotrope image with the naked eye over lines one hundred and sixty miles in length, and fifty miles is certainly not a difficult range for a field heliograph. Nor can the signal flag and torch, or some other suitable night light be neglected.

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REVIEWS.

[Publications of military interest will receive careful and intelligent notice if addressed "MILITARY SERVICE INSTITUTION, Governor's Island, N. Y. H.]

"THE COMMAND OF THE ARMY."

SAVANNAH, GEORGIA, *October 26th*, 1882.

TO GEN'L JAMES B. FRY, U. S. Army,
No. 30 East 63d, Street, New York.

MY DEAR SIR:

I received duly your note and the pamphlet entitled "The Command of the Army" you kindly sent me, and which I have read carefully and with interest. When in the Army my favorite readings were Military, Constitutional and International Law, and during my service in Washington City I studied them systematically, and enjoyed frequent opportunities of assisting and correcting my studies by discussions of their principles with eminent jurists, statesmen and military men. With these advantages, it may not be thought presumptuous in me, though no longer in the Army, to express to you conclusions in connection with the subject-matter of the pamphlet, at which I arrived before resigning from the Army, that our subsequent military history has confirmed, and which I here give you in the hope that they may aid in establishing correct opinions and practices in the Army, which is cherished in my heart to-day as dearly as if I still wore its uniform.

With your permission, I begin with the premise "that, in discussing our National Constitution, we must bear in mind strictly that it is the work of men who had been British subjects, reared in the principles of Constitutional Liberty, and accustomed to the frame of Government that distinguished Great Britain from all other governments then known; and that it was most natural that the framers of our Federal Union should adopt their inherited principles of liberty, for which, moreover, they had contended in eight years of bloody, painful war; should arrange their democratic-republican form of government in accordance with them; and take, as far as they could in its mechanism, the details of construction with which they were familiar, and which had been so imperfectly and inadequately set up in the Articles of Confederation of 1774. These framers of the Constitution were Englishmen in all the essentials of the English Constitution, and sought to maintain and perpetuate its noble principles, improved by freeing them from the clogs of an hereditary monarchy, and of privileged classes. Repudiating the 'divine right of Kings to govern,' and recognizing the people as the source of power, they ruled our constitution accordingly, by making elective what was in Great Britain hereditary, and wisely and boldly retaining to the people's servants in public station all the powers and prerogatives of the English Crown and Peerage that were necessary to give unanimity, unity, and strength to the National government created for the Federal Union."

With this bright light illuminating the way, and with the aid of the beacons erected by Madison, Jay, Hamilton, and other Fathers of the Country, and piloted by recognized standard commentators, I may now steer intelligently for the channel of my argument.

Among the attributes of sovereignty needful for the perfection of national organization, our elective chief magistrate, the President, was invested with the supreme command of the national, military and naval forces during his period of service. As the sovereign of England is the Generalsssimo of the Army and Lord High Admiral of the Navy, so our Chief Executive is, by Art. II, sec. 2 of our Constitution, made "the Commander-in-Chief" of the Army and Navy of the United States, and of the Militia of the several States when called into the actual service of the United States. This is a grant of substantive power by the States to the President, and to him alone. It is not to be supposed that the Chief Magistrate of the nation shall be qualified to command, in person, an army in the field, or direct the manœuvres of a naval squadron. Nor is it to be supposed that he could abstract himself from his other duties, civil and military, to

command, in person, on land or sea, were he competent to do so. Either supposition is an impossibility, and, therefore, both are inadmissible. How then can we interpret the practical application of a substantive power held by the President, and which he cannot delegate; using the word in its legal constitutional sense to any one? Readily, if we shape our course by our lights. How does the Constitution of Great Britain, by which ours is modelled, meet these same difficulties? It invests the sovereign with what constitutional writers term "*legal ubiquity*," which is found in the representatives allowed by Parliament or custom to the sovereign for the discharge of the various functions of government. As Blackstone says, "in the King, therefore, as in a centre, all the rays of his people are united." In like manner, our President has a "*constitutional ubiquity*" in the persons of the officers, civil and military, appointed by Congress to fulfil the various functions of our Federal Union. He is our constitutional centre, in which the rays of our people are united.

Have we not here the solution of the problem of the President's command, military and naval?

It is true there is no distinct prohibition preventing a President from taking personal command, if he may determine to assume it. But there must be a most extraordinary array of circumstances to warrant the chief magistrate in abandoning all the other interests of the government for this one exercise of power; and such an act should be gravely examined as to its merits, whether proceeding from a patriotic exigency for the "general welfare," or is an arbitrary exercise of will, dangerous to the Republic, and menacing the liberties of the people.

As in England, so have we in the United States given to our Chief Executive a public functionary known as "The Secretary of War," to be the *political* link connecting the military state with the civil state in the person of the President. As in Great Britain so with us, this functionary is a civilian having no military rank or title, and incompetent, in himself, to give any military order. In addressing the Army he is but the mouth-piece of the President, and all of his communications to it should be prefaced with the words "The President directs," or closed with the intimation, "By order of the President." But, as the President cannot take into his own hands the details of military affairs, for want of the requisite knowledge and time they call for, and as the Secretary of War, with his political duties demanding his attention, is in the same category, it is essential that the Commander-in-Chief should have some one to assist him, who has the special knowledge required, and the time to devote to it. In Great Britain this is attained by appointing from the higher grades of the Army an officer who should be near the sovereign's person, and who shall have direct charge of the military details, and give the necessary instructions for the military service. This officer is named in Great Britain "The Commander of the Forces." He may or may not be the senior officer by commission in the Army, but representing the Commander-in-Chief he oversees all the military officers in their military duties, and is, in fact, the military Chief-of-Staff to the political Generalissimo.

Such is, by analogy, the outline for our military system. But the political ambitions of Secretaries of War, and the general ignorance of constitutional military law that has prevailed, and still prevails, in our country, have so far blocked its adoption.

From the preceding review of constitutional organization, I hold that there should be connected with our War Department a "Commander of the Forces," who should oversee all the military departments and bureaux in their respective military duties, and whose chiefs with him, constitute the President's military staff. The Commander of the Forces cannot interfere directly with the appropriations for the army, as those are political matters pertaining to the political link connecting the military with the civil state; nor can he intermeddle with the civil duties assigned by Congress specially to the Secretary of War. All estimates, however, for military purposes should go to the Secretary of War for the President, *through* the Commander of the Forces, that he may examine them, and be fitted to discuss them intelligently with the Secretary and the President. There can be no difficulty in separating the military from the civil functions of the several departments. I say this from personal experience and observation. And placing the departments and bureaux under the orders of the Commander of the Forces would in no manner confuse or increase their duties. In fact, they may be simplified and diminished by introducing more concert of action in the War Department.

Such were the views entertained before January 1st, 1861, when I resigned, and the confusions of the Civil War, and after it, have strengthened them. To my mind, they frame a system of unanimity and unity, and the only method by which the intricate machinery of the military state can be made to work evenly and smoothly.

Who the Commander of the Forces should be is the final question. In our little

army, the senior officer by commission should be selected, if competent to perform the duties; and so down in succession by the rules of seniority, fitness and courtesy. The senior officer cannot claim the appointment by any absolute right inherent in his commission, but only by a qualified title dependent upon the considerations attached to rank, service, experience, qualifications and character. These and no more. But they will always plead strongly, and in general, successfully, for the senior officer who possesses them. But it must be borne in mind that the appointment is made by selection. That Washington's opinions were of this character appear, I think, in his letter declining the Lieutenant Generalcy tendered him by President Adams, and his conditional acceptance of the command of the army. For he writes, "In making this reservation I beg to be "understood that I do not mean to withhold any assistance to arrange and organize the "army which you (the President) may think I can afford." And General Halleck grasps very nearly the constitutional intention when, in his letter to Major General W. T. Sherman of February 16th, 1864, he says, "I am simply a military advisor of the Secretary of "War and the President, and must obey and carry out what they decide upon," (he should have said what the President decides, as the Secretary is only the political adviser, H. C. W.) "whether I concur in their decisions or not. It is my duty to strengthen the "hands of the President, not to weaken them by factious opposition."

There is no "poverty of language" in our grand, comprehensive, direct, forcible, English tongue, fast becoming the universal language of the world, if words are used in their proper, general or special (technical) sense, and with exact application: but confusion almost invariably follows the introduction into our discussions of foreign terms, that however unmistakably significant in their respective countries, are vague and often inapplicable in ours—as for instance, *General en Chéf, Etat Major, Landwehr*, etc.—which in French and German are definite, but which under our Constitution and its military system carry with them no positively determined ideas. We may go to other countries for improvements in the sciences and arts of war, but for our Military Laws and regulations we must draw from our inherited English Constitution, and English framed, democratic republican form of government, studying their origin and history, illuminated by a knowledge of the precise language and exact provisions of the Constitution and common law, fairly measuring their scope and spirit.

And now permit me to correct a serious error of history in the pamphlet, which is *pivotal* to the question it discusses.

On page 22 it says "And in this connection the fact may be recalled, that President "Washington in 1794 took the field in actual command of the militia of Pennsylvania, "New Jersey and Virginia, and when he relinquished immediate command he turned it "over to the Governor of the last named State."

Now the fact of history is diametrically the reverse of this statement. President Washington did not command in person the militia above mentioned on the occasion referred to, nor any other militia, nor any other troops, at any time, during the two terms of his Presidency. History tells us that in 1791, two years after the Constitution of 1787-89 had gone into effect, the whiskey distillers of Western Pennsylvania and the adjacent country refused to obey an Excise law of the United States Congress, and banded together to resist its execution. The insurrectionists were estimated at over 16,000 men, and it was reported, and believed, they could put 7,000 able-bodied, good, organized fighters in the field. Not wishing to jeopard the life of the Republic so soon after its birth, nor dip his sword in the blood of his countrymen for whom he had won liberty and independence in the long and bloody war with Great Britian, President Washington endeavored to persuade these misguided men back to the obedience of the laws of their National Government. Fruitless appeals for a patriotic compliance with the supreme law of Congress over matters of excise within the States were made, and President Washington was compelled to resort to the alternative of the military force provided for such cases by the 1st Art., 8th Section, 15th clause of the Constitution. Proclamations against the insurgents were issued, and 12,000, afterwards increased to 15,000 active militia were called for from the States of Pennsylvania, New Jersey, Maryland and Virginia. Governor Lee of Virginia was appointed to the command of this force, with Mifflin second, Howell third, and Morgan fourth in rank. Bedford, in Pennsylvania, was made the rendezvous of the militia of Pennsylvania and New Jersey, and Cumberland, in Maryland, thirty miles from Bedford, the assembling point for the quotas from Maryland and Virginia. When these troops were organized President Washington, with his Secretary of War, inspected them at Bedford and Cumberland, and, giving written instructions to Governor Lee, returned to Philadelphia where Congress was to meet in four weeks. The militia took the field under Lee against the insurgents, who incontinently dispersed, and tranquility was soon restored. Mr. Sparks in his Life of Washington, p.

500, Vol. 1st, says, "that when President Washington left to inspect the militia at Bedford and Cumberland, he had the intention of taking command of them in person, if "there should be an extreme necessity for such an exigency, but finding none he immediately returned to Philadelphia for the opening of Congress, after his inspection." But Mr. Sparks gives no authority in confirmation of this *intention*, and as it is well known a mere statement of "intention" unsupported by corroborative testimony has no positive weight, and, moreover, the troops were already completely organized under a competent commander. The statement of Mr. Sparks, therefore, is indefinite and uncertain. This is, in brief, the history of the "Whiskey Insurrection of Western Pennsylvania," as it is called, and it is clear that President Washington did not command in person the State troops called out to suppress it.

In conclusion I summarize my views thus:

I. General A. B. should be assigned to duty in the War Department as Commander of the Forces and to be obeyed and respected accordingly.

II. The Commander of the Forces and the Chiefs of the Military Staff Departments and bureaux of the War Department with their respective personal staff officers compose the Military Staff of the President under the orders of the Commander of the Forces; and in his accidental or official absence, under the orders of the senior staff officer, by commission, present.

III. The chiefs of the Military Staff departments and bureaux of the War Department will make all reports on military matters to the Commander of the Forces and receive from him their instructions and orders.

IV. Estimates of appropriations for the army, and papers to be transmitted to Congress in relation to Army affairs shall be made to the Secretary of War, *through* the Commander of the Forces for his examination and information: but the control of the appropriations when made, and of their disbursement, shall be under the direction of the Secretary of War as heretofore.

V. Estimates of appropriations for civil works, reports relating to them, and all papers not of a military character, shall be made by the Chiefs of the Staff departments and bureaux having them respectively in charge, direct to the Secretary of War or as may be provided for by law.

With this system as a basis, supported by the Rules and Articles of War, the Army Regulations, reason, and a patriotic desire to promote unanimity and unity of action on the part of all concerned, the President will be as harmoniously and strongly represented throughout the military service as he is by the diplomatic corps, and our Consuls abroad and be sustained efficiently by a military expert, in addition to his own chosen political adviser, connecting in him the Army with the Civil State.

That the senior officer by commission in the army will invariably be appointed the Commander of the Forces, unless for good cause, cannot be doubted. For although, as we have said, he has no right, inherent in his commission, to command the army, he has a qualified claim, in virtue of his rank and fitness to be selected for the appointment of Commander of the Forces, and Congress and the people will not see him set aside without due enquiry, and for cause; the President being subject to investigation for misdemeanors in military matters as well as in civil.

Further, I would caution our officers and men against too much reliance upon the disputations of interested persons contending for the triumph of individual ambitions; as their law, however accurately quoted, will be used (such is the constitution of our human nature) rather by its expediency than to elicit exact truth. Nor are despotic acts of Presidents, in ignorance of, or indifference to the Constitution; or legislation manifestly unconstitutional in furtherance of partisan ends, to be urged in determining constitutional theories and practices, other than as the exceptions proving the strength of the general rule.

In addition to the advantages already pointed out in the preceding interpretation of the Constitution and its legitimate deductions, the President is free to select his representatives in time of war, to command armies in the field, and should he designate the Commander of the Forces for the purpose, the absence of the senior officer by commission if holding the appointment will cause no break in the mechanism of the War Department, as his place can be supplied during his representation of the President elsewhere by a selection to fill it of a competent military expert, on whom the political Commander-in-Chief may rely to advise him ably, and to explain to him the details and routine of army service and movements; and who also can efficiently aid the Generals in the field in their operations.

From the 4th of March, 1789, when the Constitution went into effect, up to the Civil War, our politicians and statesmen had ignored the military state almost entirely,

confining their studies to the powers of Executive, Legislative and Judicial departments, so that it is not surprising that little was known of military law throughout the United States. And, as Cabinet offices are held to be stepping-stones to Presidential preferment, Secretaries of War, desirous of aggrandizing themselves politically, seize, like the others, upon all the influences and control within their reach, and take the reins of military government in their own hands.

Begging you to accept these remarks in the spirit with which they are written—of a sincere desire to benefit the army, if I can,

I am, very truly, yours,
HENRY C. WAYNE.

SAVANNAH, GEORGIA, *November 2nd*, 1882.

GENERAL JAMES B. FRY,
U. S. ARMY, N. Y.

MY DEAR GENERAL:

Your short note of the 30th ulto. at hand. There is no conflict in my argument if the reader will interpret technical language according to its meaning and application as determined by our Constitution, Military Laws and Army Regulations. To "inspect" troops in no manner implies command of them in person or actively; and there never was an embassador sent abroad; or a General assigned to the command of troops; or an Admiral or Commodore assigned to the command of a squadron, who did [not] receive instructions, almost invariably written, from the President. But Sparks settles that question by telling us "that Washington had the intention at one time of taking personal "command of the militia, if necessary, *but that he did not do so, but after inspecting them* "*returned to Philadelphia to be present at the meeting of Congress.*" I have seen in popular histories the statement that President Washington commanded the militia, but it was of no moment until used in argument to sustain an important assertion. Then it became of consequence, and deserving of examination by the light of standard authority. My object is to get at the *exact intention* of our Constitutional organization with regard to our Military System, and not for any triumph in argument. Special pleading in such cases therefore, is inadmissable, and to get at the truth we must, as the great constitutional lawyer, Silas Wright, said, carefully, perfectly and fully analyze the Constitution and all attending circumstances influencing its interpretation.

Very sincerely yours,
HENRY C. WAYNE.

N. B.—Strike out the word *diametrically* if you wish.

NEW YORK CITY, NOV. 23d, 1882.

MY DEAR GENERAL WAYNE:

Your letter of the 2d inst. reached me some days ago. You adhere positively, yet kindly I am sure, to your assertion that "the fact of history is diametrically the reverse" of a certain statement in my pamphlet on the command of the army. But you tell me to "strike out the word diametrically" *if I wish*. In my understanding of language, the reverse of a fact is the same as *diametrically* the reverse of it. I do not avail myself of your concession for the reason that it does not change the meaning of your remark nor reduce the force of your contradiction. The statement in my pamphlet is, "and in this "connection the fact may be recalled that President Washington in 1794 took the field in "actual command of the militia of Pennsylvania, New Jersey and Virginia; and when he "relinquished immediate command; he turned it over to the Governor of the last named "State." In your letter of October 26th, you say of this, 1st. "It is *pivotal* to the ques- "tion" discussed in my pamphlet, and 2d that it is "a serious error of history—that it is "diametrically the reverse" of the "fact of history." I do not regard the incident as "pivotal" or very important to the question. It was mentioned, as shown by the terms used, merely as an example which had arisen by chance under a rule which, I thought, firmly established by the argument of the pamphlet. As I look at it, the force of the argument would not be impaired much, if at all, by striking out the occurrence. But unimportant as the statement appears to me in its connection in the pamphlet, your flat and elaborate contradiction, demands my reasons for making it. You say, "now the fact of history is diametrically the reverse of this statement. President "Washington did not command in person the militia above mentioned on the occasion "referred to, nor any other militia, nor any other troops at any time during the two "terms of his presidency;" and you add in relation to the militia force called into the service of the United States to suppress the whiskey insurrection, "Governor Lee of Vir- "ginia was appointed to the command of this force," In both of your letters (October

26th and November 2d,) you insist that the reader shall "interpret technical language "according to its meaning and application as determined by our constitution, military "Law and Army Regulations;" and add that "to inspect troops in no manner implies "command of them in person or actively." You speak as if the constitution, Military Laws and Army Regulations laid down or "determined" an exact method for interpreting technical language. If that were so we should not be engaged in discussion. But there is no accepted glossary to the instruments you name. In the case we have in hand you say Washington did not command "in person." To be exact in technical terms, I may remind you that my pamphlet does not say he commanded *in person*. It says he took the field in "actual command," and speaks of his "immediate command." We may be differing a little about the technical meaning of "actual," "immediate" and personal command, but I think by explanation we may understand each other. As to the facts of history in the case in point, I observe that you cite no authority but Sparks. You admit that President Washington went in person to the army but you hold that his only purpose was "to inspect." In relation to his exercise of command you say, "Sparks settles that "question by telling us that Washington had the intention at one time of taking personal "command of the militia if necessary, but that he did not do so, but after inspecting "them returned to Philadelphia to be present at the meeting of Congress." Here, on November 2d, you accept Sparks as settling the question, but in your letter of October 26th, being at that time unwilling to admit that Washington ever had even the intention of taking command, you discredit this same authority by saying, "but Mr. Sparks gives "no authority in confirmation of his intention, and as it is well known, a mere statement "of intention unsupported by corroborative testimony has no positive weight." I may here remark that for the purpose of the argument in my pamphlet, Washington's intention to take command is quite sufficient even if he did not carry out the intention. Mr. Sparks could have been discredited to more advantage on some of his other statements concerning the whiskey insurrection, than upon what he says of Washington's intention to take command. For example, he says that the "Secretary of War" accompanied the President to the place of rendezvous and that the "Secretary of War went on with the "army to Pittsburg." These are mistakes. The Secretary of War, Knox, did not accompany the President, did not go to the places of rendezvous at all, nor did he go on with the army to Pittsburg. Sparks' failure to state in the text of his life of Washington that the Secretary *of the Treasury*, Hamilton, accompanied the President to the rendezvous, and went on with the army is a grave omission especially in view of the active part taken by Hamilton in *the military* as well as in the civil business of the expedition.

To return to the main point. You, adopting Sparks, say as I understand you, Washington went merely "to inspect" troops which were already organized and under the command of Governor Lee of Virginia. I think you are wrong. Washington himself says in his message to Congress, November 20th: "I ordered the militia to march, after "once more admonishing the insurgents." "If the state of things had afforded reasons "for the continuance of my presence with the army it would not have been withheld." "But every appearance assuring such an issue as will redound to the reputation and "strength of the United States, I have judged it most proper to resume my duties at the "seat of government, leaving the chief command with the Governor of Virginia."

On the 8th of October, (1794) Washington wrote from Carlisle to General Daniel Morgan saying, "imperious circumstances alone can justify my absence from the seat of "government while Congress is in session, but if these, from the disposition of the people "in the refractory counties, and the state of the information I expect to receive at the "advanced posts, should appear to exist, the *less* must *yield to the greater duties* of my "office, and *I shall cross the mountains with the troops*; if not, I shall place the com-"bined force under the orders of Governor Lee of Virginia and repair to the seat of "government."

On the 9th of October, being still at Carlisle, he wrote to Knox, Secretary of War, at Philadelphia, "it would have given me pleasure to have you with me," but "it is now "too late as we shall be in the act of crossing the mountains, or I shall be on my return "to Philadelphia, according to circumstances and the information I *shall receive at the "head of the line*, before you could arrive." "To-morrow, if I can get the troops in motion "at this place, I shall set out for Williamsport, thence to Bedford, where about the 18th "or 20th, my ultimate measures will be determined on.'

On the 16th of October, he wrote from Cumberland, to Randolph, Secretary of State, "I do not expect to be here more than two days, thence to Bedford, whence, as soon as "matters are arranged and a plan settled, I shall shape my course for Philadelphia, "*but not* because the impertinence of Mr. Bache or his correspondent has undertaken to "*pronounce that I cannot constitutionally command the army while Congress is in session.*"

On the 20th of October, Washington having arrived at Bedford, decided on the "ultimate measures" mentioned in his letter of the 8th to Morgan. He *directed Hamilton* to address a formal and lengthy letter of instructions to Governor Lee which opens by saying: "I have it in special instruction from the President of the United States now at "this place, to convey to you on his behalf the following instructions for the general "direction of your conduct in the command of the militia army with whieh you are "charged." It is in this letter that the rank of the Governors is announced; Hamilton saying, "it has been settled that the Governor of Pennsylvania will be second, the Gover- "nor of New Jersey third in command." On the same day, October 20th, Washington addressed a letter to Governor Lee in which he says, "could my further presence with "them" (the troops) "have been necessary or compatible with my civil duties, at a period "when an approaching session of Congress particularly calls me to return to the seat of "government, it would not have been withheld. In leaving them, I have less to regret "as I know I commit them to able and faithful direction."

The foregoing extracts afford conclusive proof, as it seems to me, that when President Washington in September 1794 left the seat of government for Carlisle, Williamsport and Bedford it was not merely "to inspect" a militia force which was as you claim, at that time organized and commanded by Governor Lee of Virginia. If a doubt could remain on this point it probably would be removed by what Washington himself says of his purpose. In the message sent to Congress after his return he says he "visited the "places of general rendezvous to obtain more exact information, and to *direct* a plan for "ulterior movements." What was embraced in directing a plan? *What in fact did he do?* I have said in substance that he went in his capacity of Commander-in-Chief of the militia he had called into the service of the United States, and that he exercised the actual command of that militia until he turned it over to Governor Lee of Virginia. In support of this I cite the foregoing extracts and will add a few comments. If he was not exercising command there would be no meaning in the indignation with which he spurns Mr. Bache's assertion that he could not constitutionally command the army while Congress was in session, and in his giving reasons for his return to the seat of government which were—not that he was not commanding—but, that matters were arranged and a plan *directed* so that it was unnecessary for him to remain with the army. In fact Mr. Bache's question about Washington's right to command could hardly have arisen if the right had not been exercised.

In his message to Congress, November 20th, Washington says, "*I ordered* the militia "to march," "*I* put in motion 15,000 men;" and he distinctly states that it was "*as* "*Commander-in-Chief of* the militia when called into the service of the United States," that he proceeded to join the troops. The Constitution *appoints* the President Commander-in-Chief of the Army and Navy of the United States and of the militia when called into the service of the United States. He is always on duty in that capacity. No assignment or formal announcement is necessary to the exercise by him of any command he may deem proper.

As soon as he arrived at Carlisle, he went directly and actively to work to improve the discipline of the troops there. They were disorderly, and it was feared they would burn the town. "To what heights these heats might have gone if the President had not "arrived so seasonably it is impossible to tell." "Though there were officers possessed "of virtue and experience before he arrived, yet their authority was not sufficient to pre- "serve order," etc. "After a short conversation he informed us he was just going out "about some business relating to the army, and that *after breakfast* he was going to see a "division of the army march, but would converse with us at 10 o'clock that morning." Thus he was attending in person to army business both before and after breakfast. "He "assured us that *he* would provide by dispersing the disorderly corps among better "troops, or otherwise, that they should be kept in strict subordination." "Having rode "out a few miles to see some relations, the President was *gone out to the army* before we "returned." "General Smith, who commanded the Maryland brigade, complied strictly "with *the President's orders* in discharging such of the men as were disorderly." "*The* "*President* was happily successful in reducing the licentious part of the army to subordi- "nation,"* etc., etc. This certainly indicates the exercise of "actual" and "immediate" command. The President confirms it by his letter of October 9th, already cited, in which he says, "If *I* can get the troops in motion at this place, I shall set out for Williams- "port, thence to Bedford." That he was at this time actually executing the duties of his military office is further shown by his letter of October 8th to Morgan, his letter of October 20th to Lee, and his message of November 20th to Congress. In the first he says, "if

*Findley's History of the Whiskey Insurrection.

"imperious circumstances require it, the less must yield to the greater duties of my office, "and I shall march across the mountains with the troops." In the second he distinctly contrasts the military duties he was then performing with the "civil duties" he proposed to *resume* by returning to the seat of government. In the third, after giving reasons for his return from the army, he says: "I have judged it most proper to *resume* my duties at "the seat of government, *leaving* the chief command with the Governor of Virginia." Clearly from this, he had for a time laid aside his civil duties at the seat of government, for the purpose of attending in person to military duties at the seat of war. And furthermore it appears plain enough from this that the Governor of Virginia did not have the chief command of the militia army until the President *left* it to him by quitting the field. It is true that Washington is reported to have said at Carlisle that he did not "command "the army *in person*, but had appointed Governor Lee Commander-in-Chief." The date on which he appointed Lee to command in person, or left him in chief command, is not material in this discussion. It would seem however that he had not appointed Lee as late as October 8th, for he said in his letter of that date to Morgan, if not required to cross the mountains, "I *shall*—(that is at some future time)—"place the combined force "under the orders of Governor Lee of Virginia." It seems clear that up to that date the President was exercising the command himself.

The Governors bore the same relation to their respective forces that the President bore to the whole force. He and they exercised command on exactly the same principles. For the purpose of actual military command he fixed their relative military rank as already shown. In our discussion, the historical fact of the President's part in the whiskey insurrection is important only as bearing on the *principle* of command which controls alike the President and the Governors. Admitting, that at some date not known, the President appointed Lee to command *in person*, it would still be true that up to the date of his departure, the President actually exercised the chief command himself. In his letter of October 20th to Lee he says of the troops: "In leaving them I have less to re-"gret as I know *I commit* them to able and faithful direction." You will observe the force of the present tense of the verb commit. It seems to me that it was then and there that the immediate command was relinquished by the President and turned over to the Governor of Virginia, just as stated in my pamphlet, and that you are in error in characterizing my statement as "diametrically the reverse of the fact of history."

Allow me also to say, in all kindness, that the "brief history" of the whiskey insurrection given in your letter of October 20th, is defective in making no allusion to the documents I have cited; for without considering them, Washington's part, especially in the military operations, cannot be fully understood.

A few words as to a general proposition in your letter and I shall close.

You say "it is not to be supposed that the Chief Magistrate of the nation shall be "qualified to command in person, an army in the field, or direct the manœuvres of a naval "sqadron. Nor is it to be supposed that he could abstract himself from his other duties, "civil and military, to command in person on land or sea, were he competent to do so. "Either supposition is an impossibility, and therefore both are inadmissable."

On the basis of these assumptions, after we have had more than a hundred years of experience, you would transplant from the British military system to ours, certain features and titles which the founders of our government understood and rejected. That Washington did not entertain the views you express concerning the military functions of the President, is proved by the foregoing extracts.

It seems to me there is no more unstable foundation for a military system than the assumption that the actual head of it is incompetent, and if competent would necessarily be unable to perform his duties; and so I judge the framers of our Constitution thought, for it is recorded, that "objections were made to that part of this article by which the President is appointed Commander-in-Chief of the army and navy of the United States, "and of the militia of the several States; and it was wished to be so far restrained that "he should not command in person, but *this could not be obtained*."*

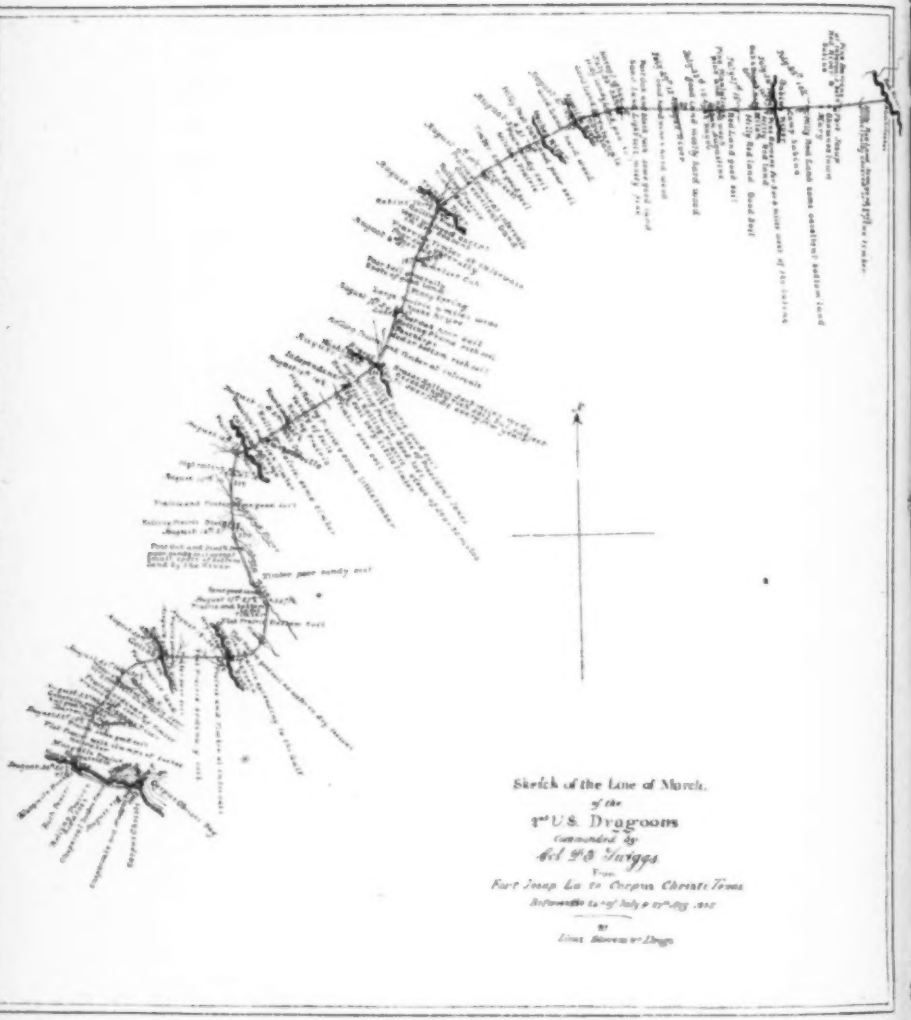
Looking from my standpoint, the only *supposition* admissable, is that the President is qualified for all the duties imposed upon him by the Constitution. The *fact* is the Constitution and laws afford him ample facilities for the efficient performance of them.

Very sincerely yours,

JAMES B. FRY.

To General H. C. Wayne,
Savannah, Georgia.

*Luther Martin's Letter to Maryland House of Representatives. Elliotts' Debate on Federal Constitution.



Sketch of the Line of March
of the
1st U.S. Dragoons
Commanded by
Col P.F. Smiggs
From
Fort Jesup La. to Corpus Christi Texas
Between the 14th July & 27th Aug. 1845

By
Lieut. Stevens 1st Dragn.

OUR CAMP CHEST.

RELIC OF OUR WAR WITH MEXICO.

Colonel George Meade (late U. S. Army) has presented to the Museum of the Institution a sketch of the route taken by the Second Dragoons, July–August, 1845, from Fort Jesup to Corpus Christi, as the advanced guard of the Army of Occupation under General Zachary Taylor. This interesting relic was recently found among the personal papers of the late Major General George Meade by his son; it was drawn by Lieut. George Stevens, 2d Dragoons, Acting Topographical Engineer, a young officer of great promise who was drowned May, 1846, while crossing the Rio Grande with a portion of his regiment to occupy the city of Matamoras.

The march is fully described by one of the participants in a letter to be found in the history of the regiment published sometime since* and from which a brief extract is made.

* * * * * *

Passing through a comparatively unsettled country, a southern clime, a six weeks, drouth, the month of August, the various contradictory reports in reference to forage, etc., with seven companies of dragoons and a train of sixty wagons might well have staggered a firmer and more practical mind. But the task voluntarily undertaken has been accomplished and the regiment and train presented to the Commanding General in such fine condition as to have elicited the admiration of our friends of the infantry regiments and a complimentary order from General Taylor himself. True we encountered difficulties on the route and obstacles that seemed unsurmountable. Starting at three o'clock in the morning, and frequently at midnight, our marches of twenty-five and thirty miles were terminated before the heat of the day. Upon our arrival at the towns and villages we were greeted by the acclamation of the multitude assembled to welcome us. * * Our losses upon the route were principally from desertion, only three deaths having occurred on the march * * * much of the distress and the consequent desertions may be attributed mainly to the circumstance that during the first six days over sixty horses' backs were injured by the miserable saddles lately adopted by the Government and the riders consequently were dismounted and made to walk the remainder of the way.

An amusing circumstance, and one that is more flattering to the regiment than any other occurrence enroute, took place at San Patricio. The regiment had made an early start (12 M.) in order to accomplish a distance of twenty-seven miles to San Patricio and cross the Nueces by means of a raft which had been previously constructed. We arrived about 8 A. M. By 9 A. M. every dragoon had swam the river with his equipments. During the whole morning and especially at this hour had been heard what was at first supposed to be firing of a salute at Corpus Christi. The continuation of the distant reports however, together with the absence of Gen. Taylor who had informed Col. Twiggs by express that he should meet him at San Patricio that day, convinced even the most skeptical that Corpus Christi had been attacked. "To Horse" was immediately sounded, then the "Advance" and the field and convalescent were ordered to remain as a guard to the train. When we were fairly under way, however, and the stragglers were all up, the officer left in charge reported that there were no sick, the number having suddenly been reduced *from fifty to nothing!* * * The regiment arrived at Corpus Christi on the 27th August, having rested eight out of the thirty-three days, and made a march of five hundred and one and a half miles.

* "FROM EVERGLADE TO CANON WITH THE SECOND DRAGOONS."—An authentic account of Service in Florida, Mexico, Virginia and the Indian country, 1836-75. Compiled by Theo. F. Rodenbough, Colonel and Bvt. Brig.-Gen. U. S. A. New York: D. Van Nostrand.

AN UNCONSCIOUS MINISTER OF WAR.

Charles XI. of Sweden, like his more famous but not wiser son, often indulged in habits more compatible with the state of a Subject than a Sovereign : he was a vigorous pedestrian and was wont to take long, solitary tramps, even in the cold season, in the neighborhood of his capital, dressed in plain and rather rough garb. One day, when out on one of those excursions, he fell in with a peasant driving an empty double sled on his return from market. The market men of that vicinity, for the convenience of different kinds of lading, frequently harness their teams to a pair of sleds, drawn one behind the other and connected by a link and bolt. This peasant, seeing a decent looking footman on a slippery road, invited the stranger to take a seat on the rear sled, and the latter accepted the civility. They soon got into conversation. The driver talked back at the stranger and the latter spoke forward to the driver. Charles soon brought up the subject of some changes, then supposed to be in contemplation, in regard to the manner of recruiting and subsisting the army. "The King," I hear, "intends to do so and so," said Charles. "The King is a cursed fool," said the peasant. "I could tell him of a much better way to raise and keep up an army." "Well," said the unknown subject of reproach, "you seem to be a shrewd man, what would you advise the King to do?" "I would," said the foremost speaker, "make each farm furnish and clothe a soldier, who, when not wanted in the field, could draw half pay while he remained at home and earned rations and wages for himself." "But," said the rear speaker, "some estates are small and others large, how would you equalize the burthen?" "I would," said the instructor of Royalty, "divide an estate into two or more homesteads, and put two or more small farms together, to make one homestead, and let each homestead produce its man." "A very good plan," said Charles, "the King ought to know of it; and I would like to hear more of it in detail. Can you not call on me when you next go to town." "Perhaps I can," said the countryman, "if you will tell me your name, and where you live." "My name," said the sled passenger "is *Carl Vasa*, and I live at the Palace." The driver started, and fixed a keen glance on his new acquaintance. He had seen portraits of the King who had a rather peculiar visage; it flashed on him at once that he had cursed the Lord's annointed to his very face. He plucked out the connecting bolt, and whipping his horses into a gallop soon disappeared with the foremost sled, while the other was left in the road with the King on it convulsed with laughter.

I do not know that Charles ever rewarded his lowly instructor, or that he ever discovered his identity, but that rough hint is said to have been the original suggester of a plan of conscription which went into effect during the reign referred to, and, for aught I know, is in force yet.

This anecdote may be as fictitious as any of the interviews between King and Clown which figure so often in the old ballad lore of England, but the Swedish gentleman who related the story to me believed that it told of an actual fact.

R. M. P.

EPIGRAM.

The following is perhaps old enough to be new to most readers of the present day. It refers to the Earl of Uxbridge who lost a leg at Waterloo while in command of the British Cavalry.

He now, in England, just as gay,
As in the battle brave,
Goes to the rout, review, or play,
With one foot in the grave.

But Fate corrected Nature's whim;
For he could walk with one:
Two legs were thrown away on him
Who always scorned to run.

P.

CONCENTRATED CRITICISM IN PINT CANS.

(Kant's Critique of Pure Reason. Translated into English by Max Muller. 2 vols. 8vo. Macmillan.)

Max Muller has translated Kant
In freer terms and fuller;
Who now will finish up the job
And clearly translate Muller?

(The Concepts and Theories of Modern Physics, by J. B. Stallo. International Scientific Series. 12mo. Appleton.)

What Science says of Force and Mass,
Our author thinks is shallow,
But who shall now presume to guess
What Science thinks of Stallo?

(What I Did in Battle. By Authors who were there. Many vols. Many pages. To be continued.

Who licked Robin Lee?
Nobody but me,
With my little Two-Three,
I licked Robin Lee.

H. W. C.

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FOR REVIEW.

Annals of Fort Mackinac. Dwight H. Kelton, U. S. Army.

War Sketches from Cedar Mountain to Bull Run. By a Staff Officer.

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Annual Report of the Adjutant General of New Hampshire, 1882.

Report of an Inspection of the Artillery School at Fort Monroe, Va. John C. Tidball, Colonel, A. D. C.

Official Register of the Officers and Cadets of the U. S. Military Academy, West Point, New York, June, 1882.

The March to the Sea. Franklin and Nashville. Jacob D. Cox. (New York.) Scribners.

The Battle at Chancellorsville. Samuel P. Bates.

War of the Rebellion. Official Records of the Union and Confederate Armies. Series I. Vol. V. Washington: Government Printing Office.

The Political Conspiracies preceding the Rebellion; or, The True Stories of Sumter and Pickens. Thomas M. Anderson, Lieut.-Col. U. S. A. (New York.) Putnam Sons. 1882.

Bulletin of the United States Geological and Geographical Survey of the Territories. Vol. VI. No. 3. (Washington.) Government Printing Office, August 30th, 1882.

Martial Law. John Howton Merrill.

Report of the Fire Department of the City of New York for the three months and year ending Dec. 31st, 1882.

The Century Co's New Home. (New York.) The Century Company.

Report of an Examination of the Upper Columbia River in September and October, 1881. Lieut. Thomas W. Symons. (Washington.) Government Printing Office.

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Magazine of American History. (New York.) A. S. Barnes & Co. July to November, 1882.

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Giornale di Artiglieria e Genio. (Roma.) March, April, May, June, July, August and Sept., 1882.

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Proceedings of the United States Naval Institute. (Annapolis). Vol. VIII. No. 2. 1882.

Applicazioni Militari degli Apparecchi Foto-Elettrici, di E. Percetto, Capitano del Genio. (Roma.) 1882.

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